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Museums, Climate Change and Energy Education: A Digital Discourse Analysis

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Abstract

The purpose of this study was to explore how science and environmentally related museums in Alberta, Canada are digitally engaging with climate change and energy education. This inquiry utilised qualitative discourse analysis to examine the discourses, dynamics and tensions present in digital museum contexts related to climate and energy education in Alberta. Drawing on Eisner's three curricula — the explicit, implicit and null — the study focused on museums' websites and social media activity. The museums studied share common foci on science, environment, or energy but range in size and location. As a long-standing energy-based economy, Alberta provides an interesting, and often contested, setting to observe climate and energy education in practice at museums, many of which exist in communities and within governance and stakeholder networks which are connected to the energy industry. Discourse-connected findings, discussion and implications are presented in relation to museums' institutional mandates, curricular initiatives, pedagogical practices, special events and infrastructure initiatives.

Keywords: Museums; climate change; energy; education; Alberta; Canada

Introduction

The western Canadian province of Alberta is a national and global centre of oil, gas and energy development (Keough & Gitter, 2021). Similar to other regions that profit from fossil fuel extraction, Alberta's oil and gas sector receives sustained criticism for its environmental record in general and climate change culpability specifically. Alberta is also typically dominated by socially conservative politics, with the recent exception of rising support for a socially democratic party (Johnson, 2023; Uechi, 2015). As such, contemporary Alberta is a contested sociopolitical region. This complexity is reflected in a range of beliefs and competing environmentally related discourses; for example, from those who view nature instrumentally as a resource to be exploited by humans to those who value protecting and living in lower-impact alignment with nature (Varzari, 2001; Venneman et al., 2022). Commonly recognised personal perspectives on climate change are also present such as alarmed, concerned, cautious, disengaged, doubtful and dismissive (Leiserowitz et al., 2021). Amidst this complexity, politicians across the political spectrum routinely express aggressive support for the province's energy sector with a particular emphasis on the oil and gas industry (Cryderman, 2023; Thurton, 2023) and cast doubt upon the severity of human responsibility for climate change (Bennett, 2020; Meyer, 2018). As a result, environmental educators who engage with energy and climate change education in Alberta often experience them

as closely intertwined (Berger et al., 2015; Chambers, 2011; Lowan-Trudeau & Fowler, 2022; Lowan-Trudeau, 2022).

Cultural institutions such as science and environmentally focused museums have the opportunity to play an important role in not only providing climate change and energy-related information, but also demonstrating climate leadership through infrastructure initiatives, ongoing and one-time programming, direct community engagement on difficult and politically charged topics, and curatorial choices and language. However, museums in Alberta often receive financial support from both the provincial government and the oil and gas dominated energy sector (e.g., Canadian Energy Museum, 2023) — a dynamic that could influence museums' perspectives on and engagement with climate change and energy both operationally and pedagogically. As such, a close examination of the climate change and energy-related discourses at work in Alberta museums as evidenced by publicly available digital media and documentation is warranted.

The purpose of this inquiry was to explore how science and environmentally related museums in Alberta are digitally engaging with climate change and energy education. We focused on the digital sphere as it emerged as a central space for learning during the COVID-19 pandemic. The restriction or total closure of physical venues led many cultural institutions and educational organisations to rapidly increase their formal and informal online offerings and social media engagement (Corres Gallardo & Ruiz-Mallén, 2023). As a result, museums' digital offerings became valuable resources for educators in school and community-based settings who could no longer lead their learners on physical excursions (Burke, Jørgensen & Jørgensen 2020; Lee, Kang, Kim & Martin 2023). In the past, single-visit field trips were the most common museum programmes for K-12 students, with a heavy emphasis on in-person, embodied visitor experiences (Ripley & Heller, 2023). The movement of educational activities into digital spaces allowed institutions and learners to re-assess and expand the pedagogical opportunities afforded by museum-based learning (Anderson, 2020; Lobo Guerrero Arenas & Zuluaga Medina, 2021).

In consideration of the tensions and dynamics described above, this inquiry was guided by the question, "How are science and environmentally related museums in Alberta digitally engaging with climate change and energy education?" This approach was methodologically informed by qualitative critical discourse analysis (Lindekilde, 2014; Rogers, 2004). Eisner's (2002) three curricula — the explicit, implicit and null — provided further theoretical grounding.

This paper begins with a review of relevant literature related to contemporary definitions for and pedagogical functions of science and environmentally oriented museums; museums' engagement with difficult topics such as energy and climate change education is also explored. The review of literature is followed by methodological and theoretical discussion and illuminating findings from Alberta. We conclude with consideration of the implications for digitally mediated museum-related climate change and energy education in global environmental learning contexts. This inquiry is linked to a broader research programme into climate change and energy education in Alberta (Lowan-Trudeau & Fowler, 2022; Lowan-Trudeau, 2022, 2023).

Museums defined

Museum-based environmental educators, who often work closely with physical environments, embraced the opportunities to transform their work using online platforms offered by the COVID-19 pandemic shutdowns (Ennes, 2021). These educators work in a variety of environmentally related institutions, including science centres, zoos, conservation sites and observatories, many of which are not traditionally associated with the museum sector or primarily thought of as being conventional museums. The "museum" is not an easily defined or characterised institution; as a concept, it possesses a deeply culturally and historically ingrained complexity. Scholars and practitioners have engaged in lively debates about the meaning of "culture" and "environment" (Sandahl, 2019), "commercialism" and "profit" (Mairesse, 2019),

and the colonial and Western nature of existing definitions (Hudson, 1998; Sandahl, 2019), to name only a few. Still, understanding how scientific and environmentally focused institutions fit into the significant ideological debates which surround museums can be instrumental in acknowledging and recognising the varied dimensions of their pedagogy.

The International Council of Museums (ICOM), which offers “a platform for questioning and celebrating heritage and collections in museums and cultural institutions” (Sandahl, 2019, p. 2), provides one definition for museums in Article 3, Section 1 of their statutes:

A museum is a non-profit, permanent institution in the service of society and its development, open to the public, which acquires, conserves, researches, communicates and exhibits the tangible and intangible heritage of humanity and its environment for the purposes of education, study and enjoyment. (ICOM, 2017, p. 3)

As early as the late 1950s, Georges Henri Rivière defined museums as explicitly including institutions with scientific and technological foci, botanical gardens, zoos and aquariums (Rivière, 1960; Soares, 2020). ICOM’s 2007 statutes explicitly preserved the spirit of Rivière’s definition, referencing both science centres and planetaria as well as nature reserves, conservation institutes and natural monuments and sites (UNESCO UIS, 2007). Thus, it is useful to describe these types of institutions as museums in so far as it allows us to learn more about how institutions function and exist within the pedagogical infrastructure of everyday life and the ongoing process of meaning making.

Political neutrality and pedagogical ambiguity

Museums are often perceived as authoritative and neutral (Knutson, 2018). However, the extent to which any institutional knowledge can be considered “apolitical” or “neutral”, even when considered scientific in nature, is increasingly problematised in emerging scholarship (Knutson, 2018). Janes (2009a) argues that the notion of “authoritative neutrality” emerged as a result of museums trying to recognise competing stakeholder interests and secure their authority and funding without alienating anyone. These stakeholders include funders, such as governments and corporate or community partners, as well as the public and community groups which they function to serve. Newell, Robin, and Wehner (2016) identify that, museums are shaped by “conceptual, material and organizational structures” (p. 1), which impact their approach to education. As a result, museums’ pedagogical activities are inherently political (Prescha, 2021) and exclusionary. As Clover and Sanford (2016) point out, museums are selective in their inclusions and exclusions as they exist in a complicated landscape of political influence, funding sources and priority settings that all influence museum curricula — both formal and informal — on topics and challenges that impact the world around them. Such actions represent an attempt to achieve educational outcomes through pedagogical practice, including on climate change and environmental education (Castle, 2006).

There is increasing interest from museum practitioners and scholars alike in critical environmental and climate change education. For example, Decker (2020) advocates for museums to take a critical role in presenting contemporary issues of social, racial, environmental and other kinds of justice. In so doing, scholars such as Decker compel institutions to challenge the hegemonic “downward” or “top-down” approach (Pedretti, 2002) to pedagogy and centre communities. Further, Trofanenko and Segall (2014) problematise museums’ “pedagogical ambiguity” which represents the increasing tension for museums and educators regarding the educational role of the institution. As a result, the ability for museums to provide educational environmental messaging while being receptive or responsive to the concerns and interests of communities is increasingly being questioned (Knutson, 2018). Climate education in museums, in

this changing context, has the potential to shift from being a topic for education to a space for “complex reflectivity and creative imaginaries” (Cameron, 2011, p. 90; Cameron & Deslandes, 2011). Sutton et al. (2017) speak not only to the potential for museums to fill a critical role in educating and facilitating conversation for visitors, but also to a responsibility which they have as institutions which are central to communities and hold public trust.

Museums’ responsiveness to competing stakeholder interests are present in their public and curricular choices regarding climate, energy and environmental education, where climate change, in particular, has become a contested knowledge field. Similar to the United States where the issue of the existence of climate change is highly politicised, with opinions on the phenomenon’s existence being firmly drawn along partisan lines, climate change is a contested topic in Alberta (McCright et al., 2016; Meyer, 2018). As such, any public institutional discussion of or engagement with climate and energy education has an inherently political dimension which may be at odds with the pervasive opinion of museums as neutral or apolitical. An example of these competing interests was apparent in the Tate Museum of Modern Art’s decision to celebrate the contributions of British Petroleum’s (BP) to their corporate art sponsorship programme during BP’s 2010 oil spill in Mexico (Chong, 2015). There is a duality of climate education in museums which is concerned with both “physical reality and social discourse” (Cameron & Deslandes, 2011). As a result, how museums approach pedagogy on these topics can be a complicated process to consider.

As scholars and communities alike begin to explore how museums can better serve a diverse public, science and environmental education in general and climate education specifically are being drawn into debates of authenticity (Jones et al., 2020). There is increasing movement towards a more imperative focus on climate education in museums via a shift from the provision of information in support of the existence of climate-related challenges to the process of conveying information and engaging with visitors in a way that will activate them (Sutton & Robinson, 2020). As Sutton and Robinson (2020) suggest, knowledge alone has been shown to be insufficient in activating people towards climate action. Activation of museum visitors towards climate action requires engagement, and that engagement should be done in a scalable, sector-wide manner (Sutton & Robinson, 2020). Further, developing community-level scientific literacy is also essential to collective action (Hamilton & Christian Ronning, 2020, p. 17); promoting environmental and scientific knowledge within a societal group makes it possible to address and solve problems which are faced by the entire group (Hamilton & Christian Ronning, 2020). Museums have “the diverse physical and intellectual resources, abilities, creativity, freedom and authority to foster the changes the world needs most” (Sutton et al., 2017, p. 151), equipped with influence and collaborative authority to make communities better, more resilient places to live.

Museums are not often centred in discussions of climate change and the impact of environmental degradation on communities (Janes, 2009b). Despite this, museums remain both civic and intellectual spaces for innovative thinking, having both a responsibility to engage with communities on these issues and an exciting potential opportunity for interdisciplinary, creative thinking on existing issues (Janes, 2009b). New forms of learning are facilitated by museums as spaces of critical, discursive spaces for learning that go beyond consuming information and seek to empower the visitor to actively engage and the museum practitioner to be a facilitator (Clover, 2018). The goal is for visitors to leave institutions with a sense of themselves as empowered actors in the story of creating a positive future (Anderson & Williams, 2013, p. 256). Lyons and Bosworth (2019) argue that museums, should they choose to abandon notions of neutrality, can use their existing resources to become grassroots “commons”, like other public spaces. Scholarship has established a close link between the movement away from perceived neutrality and towards community- and learner-centred development (Hackett, Holmes & MacRace 2020; Hohti, MacLure & Chalk 2023) as embodied, for example, by climate-related actions by a variety of museums (Knutson, 2018; Massie & Reyes, 2021).

Engaging difficult topics

Difficult and sensitive topics are a major focus of existing literature concerning museum pedagogy and the role of the museum in the contemporary world (Hansson & Öhman, 2022). Environmental education, and especially education related to climate change, is often considered one of these “difficult” topics as it is deeply ethically, politically, emotionally and cognitively evocative for learners (Hansson & Öhman, 2022; Russell & Oakley, 2016; Van Poeck et al., 2019). Museums have the capacity to engage in sensitive dialogues with, and thereby empower, communities to encourage climate change education and action (Drubay & Singhal, 2020).

Climate change education can challenge how learners perceive and interpret their world not only intellectually but also materially (Hansson & Öhman, 2022), resulting in an implicitly or explicitly cognitively difficult learning experience. Bonnell & Simon (2007, p. 81) describe how difficult exhibitions have the potential to inspire critical historical consciousness through public history. As the social and scientific dimensions of environmental education are linked inexorably, Witcomb (2013) discusses how museums’ “material, aesthetic, and spatial qualities” (p. 256) contribute to the meaning and knowledge creation processes. Museum-based climate and environment education that acknowledges the importance of time and space contexts, need for community grounding, complexity of environmental knowledge, value of collaboration is required (Bell & Clover, 2017; Cameron et al., 2013; Cameron, 2012; Newell, 2020). Although there has been an increase in research on how museums engage with social issues in society, less attention has been paid to topics of climate and the environment (Bell & Clover, 2017; Rousell & Cutter-Mackenzie-Knowles, 2020). However, inspiring and instructive exemplars are available.

For example, Main et al. (2020) document the National Museum of Australia’s response to the bushfires which impacted a significant portion of Australia in 2019–20, including technical, cultural and emotional dimensions of the crisis. Main et al., argue that museums are uniquely situated to “acknowledge and honor” (p. 699) the social and ecological artefacts of climate emergencies and generate community action and empowerment. Similarly, Climate Museum UK is a mobile, digital museum that utilises community social engagement to encourage response to the climate emergency (McKenzie, 2020). Arfvidsson and Follin (2020) studied the Human Nature exhibition at the National Museums of World Culture in Sweden through a number of its main themes. Central to the exhibition are notions of commercialism, mass consumption, connectedness, violence, systems change, and more, demonstrating the inexorable link between the social and environmental components of environmental education.

The dynamics and tensions described above related to museums, energy and climate change, were further transformed with the onset of the COVID-19 pandemic which led many cultural institutions to move their educational outreach operations online via websites and social media (Burke et al., 2020; Lee et al., 2023). The digital context provides a unique lens, proliferated by the mass closures that were a result of the spreading virus. As such, by exploring how the continued existing tensions and conditions of climate change education manifest in a digital context, it is possible to make new connections between the theoretical conditions of learning and what content is being produced and disseminated by institutions. The methodology and methods guiding this study are described below.

Methodology and methods

This study was guided by critical and interpretive paradigms (Lincoln et al., 2018) and a qualitative text-based critical discourse analysis (CDA) methodology (Lindekilde, 2014; Machin & Mayr, 2012; Wodak, 2004). CDA has been employed in a range of environmental education research related to regional and national curricula (Hufnagel et al., 2018; Lowan-Trudeau & Fowler, 2021; Lowan-Trudeau, 2022), textbooks (Hussein, 2018), educational policy (Mejía-Cáceres et al., 2020; Sauvé et al., 2007) and news media (Lowan-Trudeau, 2021). CDA builds upon the convergent

scholarship and influence of critical linguists (e.g., van Dijk, 1993) and social theorists (e.g., Foucault, 1971; Ricœur, 1971) to identify and explore a range of perspectives on pressing societal topics. For the purposes of CDA, discourses may be identified in various manifestations of “text” which include written, spoken, or visual forms (Ricœur, 1971). Textual creators may compete with each other for discursive hegemony within a given social context in an effort to establish the societal dominance of their perspective on a certain topic (Takahashi & Meisner, 2012; Varzari, 2001). Within the present inquiry, we focused on identifying how discourses related to climate change and energy were manifested in the digital communications of science and environmentally related museums in Alberta.

Eisner’s (2002) three curricula — the explicit, implicit and null — provided further theoretical grounding for our analysis. The explicit curriculum refers to direct communication provided by museums such as the specific words used and messages provided in their digital media. For example, we searched for instances wherein institutions explicitly used terms such as climate change, energy, or other related words and phrases (e.g., greenhouse effect, oil and gas, petroleum, renewable). The implicit curriculum denotes the implied messages of what is published. For example, an explicit emphasis on the development of renewable energy technologies or concern for climate change would indicate that these are topics of concern for the institution. Finally, the null curriculum refers to the discourse related messages that are communicated by what is not presented at all. For example, a lack of emphasis on or minimisation of climate change by an energy-related science museum would indicate that climate change is not a priority topic for that institution. Employing the three curricula in the manner described above and exemplified below assisted us in identifying key examples, or lack thereof, of climate change and energy-related discourses in Alberta science and environmentally related museums’ digital communications.

Methods

In keeping with the digital focus of the study, we conducted targeted textual analysis of publicly accessible websites and social media accounts (e.g., Facebook) for science and environment related museums in Alberta between January 2022 and July 2023. In keeping with established approaches to qualitative CDA (Machin & Mayr, 2012), we engaged with a relatively small number of texts through close reading (Smith, 2016) and review guided by the methodological and theoretical influences described above. Our focus was on museums’ engagement, or lack thereof, with climate change and energy-related topics.

Reviews were conducted collaboratively. Francesca conducted the initial museum identification and reviews of digital texts. Francesca and Greg subsequently considered, discussed and refined Francesca’s selections and interpretations. We identified the overarching organisational themes presented below by iteratively drawing upon this collaborative process. Having two researchers examine the texts enhanced our individual and mutual understanding of and confidence in our findings and interpretations (Belgrave & Smith, 2002).

Museums examined

Table 1 and Figure 1 below provide important contextual understanding for readers unfamiliar with Alberta. Table 1 includes basic demographic information such as population for museums’ host locations as well as insight into their primary funding sources. Figure 1 is a map that further illustrates the geographical locations of the museums examined in this study. Museums were selected if they were based in Alberta, aligned with the description of science and environmentally oriented museums described earlier, and appeared to engage with climate change and/or energy upon initial review. As demonstrated by Figure 1, we also strove for a geographical balance across the province.

Our findings are presented below.

Table 1. Museums examined: location & funding

Museum	Location	Primary funding source(s)
Oil Sands Discovery Centre	Fort McMurray, the urban centre of Wood Buffalo municipality in northeastern Alberta and hub for Alberta’s oil/tar sands (pop. ~75,000)	Government of Alberta (government facility)
Philip J. Currie Dinosaur Museum	Wembley, a small town in northwestern Alberta (pop. ~1700) west of the city of Grande Prairie	County of Grande Prairie; County of Saddle Hills; ad hoc government, corporate and private donations
TELUS World of Science	Edmonton, a large city in central Alberta and the provincial capital (pop. ~1,100,000)	Telus (a communications corporation); City of Edmonton; Government of Alberta; Government of Canada; ad hoc government, corporate and private donors
Canadian Energy Museum	Leduc County, a semi-rural municipality south of Edmonton with strong ties to the oil and gas industry (pop. ~15,000)	Government of Alberta; Corporate (currently both renewable energy and oil and gas firms); ad hoc government, corporate and private donors
Big Valley Creation Science Museum	Big Valley, a village in east central Alberta (pop. ~350)	Privately owned and operated; Ad hoc private donations
Royal Tyrrell Museum of Paleontology	Drumheller, a town in east central Alberta (pop. ~8000)	Government of Alberta (government facility); Government of Canada
TELUS Spark Science Centre	Calgary, Alberta’s largest city, a corporate centre for the oil and gas industry in the south of the province (pop. ~1,410,000)	Telus (a communications corporation); City of Calgary; Government of Alberta; Government of Canada; Ad hoc private and corporate donations

All population statistics retrieved from: Government of Alberta (2023). Municipal (census subdivision) population estimates: 2016-2022 (updated January 11th, 2023). <https://open.alberta.ca/dataset/alberta-population-estimates-data-tables>.

Findings

Science and environmentally related museums in Alberta engage with climate and energy education through various digital and pedagogical modalities from a range of perspectives. Such initiatives may be thematically reflected in institutional mandates or similar, linked to programming through curricula and special events, or infrastructure-related initiatives. As might be reasonably anticipated, there was an institutional diversity of emphases within each thematic area with some museums presenting stronger digital evidence than others in certain areas.

Institutional mandates

Climate change and energy-related themes are prominent, if not explicit, in the institutional mandates and other publicly targeted statements of several Alberta museums. Mandates, and other guiding policy documents, outline strategic priorities and objectives that drive educational programming and inform the purpose of educators’ work. As public-facing statements that are developed on a governance level, these documents, and the themes within them, can provide valuable insight into the priorities and considerations that museums position at the forefront of their pedagogical activities. The majority of science museums are not exclusively concerned with energy as their subject and, ergo, those that do include references to energy and climate change in their statements, do so in a broad sense. For example, the [Royal Tyrrell Museum of Paleontology’s](#) (2023) vision states that it seeks to, in part, “foster a better understanding of the past, nurturing stewardship of our changing planet” (para. 1).

In the case of science museums that are explicitly concerned with energy and climate-related themes, language and themes vary. For example, the [Canadian Energy Museum](#) (2023) in Leduc

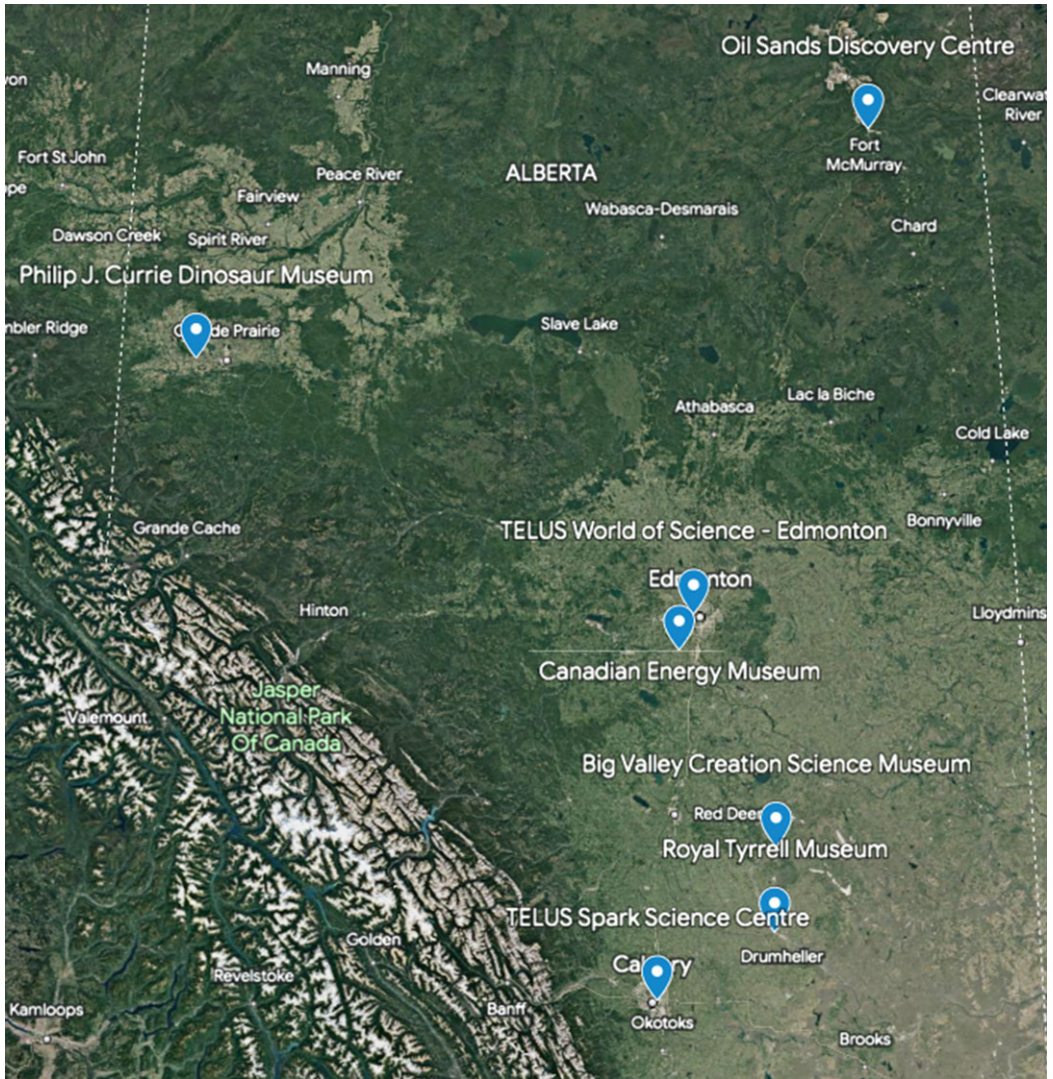


Figure 1. Museums examined: location.

County states that it seeks to “cultivate curiosity, engagement, and a balanced understanding of the energy sector” (para. 3) and promote its vision to “showcase and celebrate the ongoing and ever-changing story of energy heritage and history” (para. 4) and “inspire a lifelong enthusiasm for energy heritage” (para. 4). In a similarly explicit manner, the [Oil Sands Discovery Centre](#) (2023) in Fort McMurray expresses a topical focus on the “history, science, and technology of Alberta’s Oil Sands” (para. 2). Institutional mandates are not the only form of discourse available for analysis; however, they are an interesting reflection of the carefully crafted strategic directions developed by museums and are usually permanent in a way that events, curricular programmes and special events are not.

As previously mentioned, museums in Alberta approach climate change and energy education in a variety of ways, often partially dependent upon their main subject matter. Some museums also explicitly or implicitly contest contemporary climate science and science more generally in their institutional mandates and descriptions. For example, the Big Valley Creation Science Museum

(BVCSM, Welcome, n. d.), which aspires to “refute the lie of evolution,” ascribes to a young-earth creationist interpretation of the Christian book of Genesis (Wendel, 2011) which claims “that the earth was created in six 24-hour periods less than 10,000 years ago, that most of the geologic column was laid down in a year-long worldwide flood, and that life was created suddenly [. . .] in its present form” (Wendel, 2011, p. 39). As a result, the BVCSM seeks to display its physical artefacts and material in a way that encapsulates an interpretation and theory in accordance with their perspective. Interestingly, the BVCSM (*A Look Inside the Museum*, n. d.) does engage with the notion of environmental change in describing a display related to “the geological column, the fossil sequence and profound evidence for a past, global flood” with further connections to the story of Noah’s Ark. However, this “flood geology” perspective has been consistently disproven by geological scientists (Montgomery, 2012).

Curricular initiatives and special events

Climate change and energy are also consistent themes in Alberta museums’ programming through curricular offerings and special events as shared via websites and social media. As opposed to institutional mandates, educational programming is created by museum practitioners, not governing structures, and reflects interesting interpretations of the museum’s overall objectives and approaches to climate change and energy education. These topics are arguably most prominent at institutions that focus primarily on natural resource extraction. For example, the *Oil Sands Discovery Centre* (2022) offers programming on climate and environment in relation to energy and natural resource development, including courses where students “experience the story of the Athabasca oil sands through discussions, games, and hands-on experiments” (Digging Deep in the Oil Sands (Grades 4–5) section), “discover the forest ecosystem, trees of the boreal forest, and what impacts humans have when developing the land”, and “develop a better understanding of the Earth and its changes” (Forest Detectives (Grade 6) section). Similarly, the *Canadian Energy Museum* (2022) offers virtual courses for students in a variety of grades, that cover topics including: “how human activity causes environmental changes in various ecosystems” (Keeping It Real section), “the environmental effects of oil mining” (Junior Chemists section) and “the environment, how oil is extracted, and how this process impacts the Earth” (Talk to the Trees section (Grades 4–9)).

Non-energy-focused institutions also refer to themes of climate change and energy in their online, permanent programming. For example, the TELUS World of Science (2023) offers *Planet Power*, an on-demand video programme for students that describes how “electricity is almost indispensable, but there are challenges ahead as we work to meet the growing energy needs of our industrialised world, while also protecting the health of our planet” (para. 3) and how science is working “to create a sustainable and cleaner energy future” (para. 4).

The TELUS Spark Science Centre (2022) offers an *online workshop* linked to provincial science curriculum expectations for grades 2–4 focused on polar bears, where learners are told they will see “how humans can help protect their future” and “engage in conversations about wildlife conservation and climate change.”

Websites and social media are, similarly, used to promote climate and energy-related initiatives held by museums, both virtually and in-person. For example, on May 13th, 2023 the TELUS World of Science in Edmonton hosted an *in-person workshop* on energy and climate in conjunction with the University of Alberta’s Future Energy Systems programme, which allowed learners to “Explore sources of electricity, learn about land reclamation, practice sustainability and more as researchers guide you through fun experiments, crafts, and activities suitable for kids and families” (para. 1). Similarly, the TELUS Spark Science Centre in Calgary employed social media (Facebook) to promote a climate change related *event* featuring science communicator Bill Nye that more generally discussed “global challenges, both natural and unnatural, and then explain[ed] how we can survive, mitigate, and even prevent them” (para. 3).

Fossil fuels and paleontology

One unique, and arguably under acknowledged, discourse that we encountered relates to the relationship between paleontology, fossil fuels and climate change (Kiessling et al., 2023) in Alberta. Two Alberta museums in particular demonstrate this relationship: the Philip J. Currie Dinosaur Museum (PJC) and the Royal Tyrrell Museum of Paleontology. The [PJC website](#) describes an exhibit that is dedicated to this relationship:

Geology and paleontology have played enormous roles in the modern economy of Alberta, guiding oil and gas exploration. Exploring and extracting fossil fuels is both an art and science. Despite their economic importance, many people have little understanding of how oil goes from deposits in the ground to gasoline in their car. This gallery is designed to help visitors understand technology and processes associated with oil and gas extraction and refining. (Philip J. Currie Dinosaur Museum, Exhibits & Collections, 2023)

In a [Facebook post](#) commemorating Earth Day, the Royal Tyrrell Museum of Paleontology (2022) suggested that through “advances in technology, scientists around the world are able to work together to understand our changing planet. Modern computer models can help us test hypotheses, draw conclusions about past events and make predictions about future climate systems” (para. 1).

Infrastructure initiatives

Some Alberta museums also demonstrate climate leadership through the sharing of infrastructure initiatives. Changes to the museum’s physical space represents a public-facing investment in and involvement with climate change mitigation and, in some instances, adaptation. In the majority of cases, these projects are also paired with opportunities for public, pedagogical programming. Statements or dedicated websites which describe energy initiatives often link the missions or objectives of the museum, as they relate to sustainability and science, with climate mitigation initiatives, intended to teach visitors about climate change and the impact of the institution on its surrounding environment. For example, the TELUS World of Science’s Aurora Project, an extensive set of renovations that began in 2016, included multiple energy-related initiatives. The [TELUS World of Science](#) (2023, para. 3) describes [the project](#) as “[a] reimagining of TELUS World of Science – Edmonton. It will redefine what a science centre can be” and upon completion of the project through a partnership with the [Municipal Climate Change Action Centre](#) (2023, para. 2), “every gallery in the science centre will have been updated to address emerging trends in science and technology from a uniquely Albertan perspective.” Among the initiatives included in the project is a large-scale solar photovoltaic installation that is expected to generate an estimated 41,000 kWh per year. In addition, the project includes an interactive wind turbine exhibit, funded by Capital Power, who suggest that their interest in funding the exhibit is aligned with their desire to “deliver responsible energy for tomorrow through innovation, expertise, and of course, science and technology” ([TELUS World of Science](#), 2020, para. 4).

Another example of a similar infrastructure project is the Renfrew Solar Carport at the [TELUS Spark Science Centre](#) (2021), which describes the initiative as “a beacon of environmental stewardship for Spark and the community” of Renfrew by contributing to the local economy through job creation and technological advancement.

Discussion

The primary focus of this study was the content published online by museums on either their own websites or on privately owned, publicly accessible social media websites. Institutions represented differences in foci, locations and organisational mandates that contributed to an overall lack of a

sector-wide approach to engaging digitally with climate change and energy education. This is characteristic of the museum sector, in general, but makes generalising difficult (Sutton, 2020). Although there does appear to be inconsistency in how institutions and the museum sector in Alberta, and in general, discuss themes of climate and energy, conversations regarding climate change specifically as a contested subject arguably represent a minority of discourses. There were notable instances of energy being mentioned without discussions of climate change; however, the impact of humans on their environments is a present discourse on most museums' websites or social media profiles, to varying degrees.

Explicit, implicit and null curricula

The explicit curriculum which links climate change to energy manifests itself, most commonly and perhaps unsurprisingly, in the form of curricular programming. Most often, institutions use online platforms to advertise the descriptions of courses, workshops, lectures, films and other events which discuss energy, climate change, or both. Institutions rarely offer educational materials online for free. As a result, the extent to which this study was able to evaluate the explicit curriculum was restricted to the institutions' descriptions of programming. Course descriptions are offered quite frequently and mentions of climate change and energy occur for institutions with various foci. However, explicit links are often made to formal provincial curricula. For example, the school programmes offered by the Oil Sands Discovery Centre (2022) mentioned above each explicitly reference the curricular connection that each educational programme meets for its targeted age group (e.g., Grade 6 Science).

The implicit curricula is apparent in museums' online discussions of energy and climate change manifest in a number of ways. Corporate and government affiliation is apparent on a number of platforms used by museums. These visual cues direct learners towards various stakeholders and indicate potential inclusions and exclusions that influence the institution's pedagogical choices (Newell et al., 2016). For example, the Oil Sands Discovery Centre is heavily branded with Government of Alberta signifiers such as logos, emails and indicators of trademarks. The Canadian Energy Museum thanks its sponsors at the bottom of their homepage, including [Greengate Power Corporation](#), an Albertan renewable energy company; the Government of Alberta; Aspenleaf Energy Limited, "a private oil and gas exploration and production company" (Aspenleaf Energy, 2022, para. 1); and [Pembina Pipeline Corporation](#). Similarly, the TELUS World of Science advertised a wind turbine exhibit which was funded by [Capital Power](#), an environmentally oriented electricity corporation, and the TELUS Spark Science Centre utilised the name of a local community, Renfrew, in their solar powered carport. The use of government and local names in online activities for institutions implicitly links the project with the broader community. In the case of the Oil Sands Discovery Centre, the utilisation of Alberta government branding lends implicit authority to the institution as well as implied allegiance to the closely associated petroleum industry. In the case of the Canadian Energy Museum, the inclusion of both government and energy industry branding makes such connections even more explicit. These dynamics are also potentially indicative of the institutions' values regarding energy and climate change.

Museums' null curricula are often clear in their online statements of purpose. Although many museums express general commitments to the environment and sustainability in their institutional mandates or governance documents online, energy and climate change specifically are variably mentioned. The purpose of these documents is not explicitly pedagogical; nevertheless, the authority of the institution is necessarily present in materials that are for public consumption. As a result, their decisions to include or exclude certain concepts in online statements are notable. Sustainability and environment are mentioned by most science-focused museums; however, explicit discussion of the energy sector's contributions to climate change is decidedly less common in those closely associated with the conventional (i.e., oil and gas) energy

industry. In institutions which deal directly with the energy sector, one might expect that such a link would be more apparent. However, we might fairly surmise that such absences and inconsistencies are due to close funding and professional relationships between Alberta's energy sector, government and many museums as previously discussed. The Canadian Energy Museum, for example, does provide a notable example of an explicit link between energy and climate in much of its online programming; however, it does not do so in its mission, vision, or history on its website. Similarly, the Oil Sands Discovery Centre mentions energy and technology in its institutional description, but includes no mention of climate change. In contrast to the explicit and implicit associations between the energy industry and climate change which are more apparent in the work of other science museums such as the Telus' Spark Science Centre and Telus World of Science, the lack of connection is stark in many energy-focused museums' online materials.

Online, museums have permanent and temporary options to communicate with their public audience. Our study indicated that there is a tendency for museums to primarily approach climate change and energy education through temporary events, in their descriptions of educational offerings, and when showcasing specific galleries or exhibits in the museum's brick-and-mortar spaces. What is notably absent, however, are permanent pedagogical curricula focused on the relationship between climate change and energy on Albertan science museums' publicly accessible online platforms. Material which is somewhat permanent, such as blog posts or videos, are often missing from websites after a certain amount of time has passed. Similarly, posts on social media quickly disappear from circulation. So, although museums occasionally use these temporary events or social media posts to make explicit links between energy and climate change, they are still, in a way, temporary. These observations represent an interesting pedagogical dimension of the digital approach to climate change and energy education that museums undertake, including how permanence, perceived audience (i.e., stakeholder, public, children) and purpose of material can all influence the curricular and pedagogical choices that museum educators and administrators make.

Implications

Literature has recently pointed to museums' capacity to be motivators of social and ecological grassroots change by communities (Hamilton & Christian Ronning, 2020; Lyons et al., 2019; Swim et al., 2017) and enable child- and youth-led action on critical topics within environmental and climate change education (Hackett et al., 2020; Hohti et al., 2023). This capacity may be realised in museums' interconnected curricular efforts and direct engagement with their communities both in-person and at a distance. Digital platforms allow for an in-the-moment snapshot of the complicated landscape of competing interests that the museum must navigate when seeking to utilise technology to teach about the environment and climate change. As a result, considering the digital outputs of museums' online programmes provide interesting opportunities to discuss not only what is produced, but also why. Given the increasing interest in re-imagining what museums do and how they serve communities, the emerging interest in digital engagement is an opportunity to engage directly in radical and grassroots learning and change.

From a practitioner perspective, this study demonstrates how existing digital programming can serve as an important starting point to understand the emerging relationship between museums' content, curricula and community-based action and environmental education. Further, this study offers the opportunity for practitioners, in engaging in community-based education and approaching existing and emerging programs, the opportunity to contemplate how their own institutions might approach digital education as part of larger, intentionally developed pedagogical programmes.

This study revealed a degree of diversity in science and environmentally oriented museums' approaches to climate change and energy education in Alberta in particular, which is characteristic of the museum sector, in general (Henry & Carter, 2021; Newell et al., 2016; Sutton et al., 2017). As a result, it has applicability for practitioners in multiple jurisdictions and diverse institutions. Further, the review of museums' mandates and online presence draws attention to a lack of any significant or consistent commitments to facilitating digital content that is part of a larger, intentional pedagogical programme at an institutional level. As such, museum administrators and educators would be well advised to develop more intentional pedagogical and curricular plans supported by the museum- and environmental education-specific scholarship explored in this study to effectively and intentionally approach topics of energy and climate education in both online and in-person spaces.

The diversity of approaches and discourses evident from the museums in this study, even within a limited geographical jurisdiction, may provide educators and administrators with a wide range of potential examples to take into consideration when engaging in future planning and programming. Considering how explicit, implicit and null curricula on climate and energy education are presented by a diversity of museums (rural/urban, small/large, topic-foci) will allow for the findings of this study to be applied to other institutions and regions, regardless of their specific contexts or circumstances. In so doing, museums may identify new lenses from the discussions provided by this study to examine how their relationships with funders, the unique characteristics of digital material and platforms, and their own use of language may impact their community-based programming on environmental education.

Conclusion

In this inquiry, we reviewed relevant literature and employed qualitative discourse analysis to provide illuminating examples of how implicit, explicit and null curricula impact science and environmentally oriented museums' digital climate change and energy education in Alberta, Canada. Consideration of the potential influence of Alberta's long-standing energy industry and conservative politics upon museums via funding or other relationships provided an additional lens to critically view and understand the examples identified.

This study was limited to exploring digital components of science and environmentally oriented museums in Alberta. Interviews or other field research with administrators and educators from the aforementioned museums or similar institutions elsewhere, as well as K-12 teachers and students who access their online resources, may provide additional insights. The contemporary emergence of and further possibilities for youth-led re-imagining of museums in relation to contemporary social and environmental issues could also be explored through digital lenses (Hackett et al., 2020; Hohti et al., 2023). Finally, further inquiry into public understanding and perceptions of the geological links between paleontological activity, fossil fuel extraction and climate change specific to the Alberta context and other geographically similar regions, would prove illuminating.

Science and environmentally oriented museums are well positioned to not only facilitate climate change and energy-related programming and pedagogical interventions, but also provide climate leadership through infrastructure initiatives and community engagement.

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