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INSIDE: PUBLIC LIBRARY RESPONSES TO COVID

PLUS: MUSEUMS, STEM, AND SOCIAL ISSUES, SEIZING NEW OPPORTUNITIES, MAKING MINING MODERN AGAIN, AND MORE!

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MUSEUMS, STEM, & SOCIAL ISSUES: AN ONGOING CONVERSATION

By Kris Morrissey, Theresa Ball and John Fraser

SUMMARY

Addressing Societal Challenges through STEM is an NSF-funded study to examine how informal STEM learning institutions are engaging with and addressing the challenges facing society and how STEM knowledge is situated within those efforts. Initial results suggest that ISL institutions are addressing some topics, such as climate change

and health, but avoiding other topics, such as economic disparity and issues of gender identity. Most projects focus on impacting individuals' understanding of the problem and motivation to change behaviors that may contribute to the problem; Only a few look at the complex societal factors at play and how individuals might affect systemic change. Collaborations are common but primarily between

science-based institutions rather than across disciplines. Within the STEM disciplines, science is most commonly represented, and engineering and mathematics are less commonly acknowledged as a discipline or a way of thinking.

INTRODUCTION

In November 2020, President-elect Joe Biden identified four priority areas for the incoming administration: COVID-19, climate change, economic recovery, and racial equity. These crucial areas of national interest will be the focus of media attention, policy debates, funding initiatives, and community discussions over the next four years. Will museums be part of these important conversations and initiatives? Are there opportunities for museums to affirm or to reposition their roles within the difficult public deliberations ahead? Addressing Societal Challenges through STEM (ASCs) is a research synthesis conducted by Knology with funding from the National Science Foundation (#1906556) to examine ways that science centers and museums are addressing social issues. In this paper, we look at Biden's four priorities and share a few observations about the trends, gaps, and opportunities we see in the studies we're examining.

TOPICS ADDRESSED AND NOT ADDRESSED

We drew our literature from three sources: informal-science.org (largely including summative evaluation reports), peer-reviewed journals, and master's and doctoral theses published through ProQuest research database. We hypothesized that including all three of these sources would provide a more comprehensive view of practices across the field than one source, while still limiting our inventory to work that had undergone some level of professional review.

To identify studies related to social issues, we searched for literature that made an explicit claim to be addressing a "social issue", "social problem", "socio-scientific topic," or similar terms. We also created a list of topics that were common across a number of recent public opinion polls, using polls that were rated as reliable (Silver, 2018). We eventually selected 233 studies published since 2000, with 109 peer-reviewed articles, 49 reports from informal-science.org, and 75 dissertations or theses from ProQuest database (See Figure 1).

We noted whether the studies took place in institutions that were described as STEM-based (e.g. zoos, aquariums, science centers, science museums, nature centers, etc) or other types of institutions (e.g. history museums, art galleries, childrens' museums). This allowed us to look for patterns and relationships between topics and institutional type. Applying NVIVO's textual search tool, we created

Figure 1. Inventory Sources

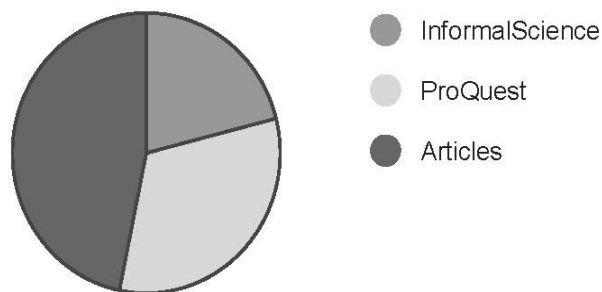


Figure 1. Inventory Sources.

a snapshot of where the topics were situated within the literature. Figure 2 shows the top ten most frequent topics.

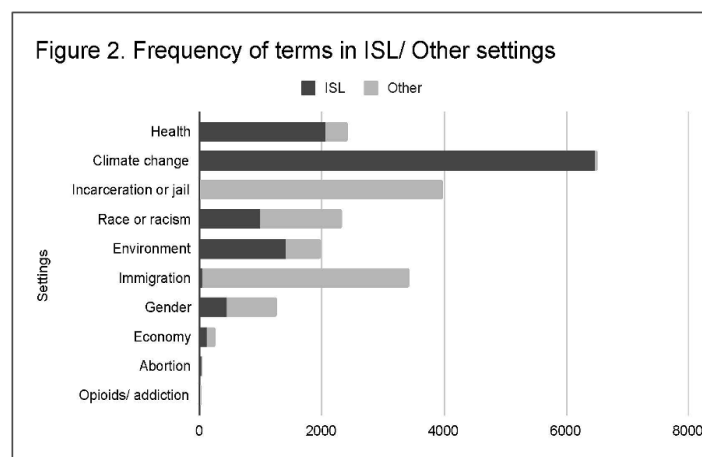


Figure 2. Frequency of terms across studies conducted in STEM-based and other types of institutions.

Climate change was the most frequently occurring term, almost always in studies conducted within STEM-based institutions. There was almost no evidence of projects addressing the highly contested topics of abortion or opioids or a number of other current issues. Some topics, such as immigration or incarceration, were evident in non-STEM based institutions but rarely in science-related institutions. While these differences might be expected, they also raise questions about what is lost and what could be gained by bringing STEM knowledge and ways of thinking to some of those topics.

While the frequencies provide a simple way to see the topics addressed, articulating the impacts of the project addressing those topics is more challenging. We started with identifying whether the papers had evidence of collecting and analyzing data and labeled those studies as "empirical." Studies that described a project or an initiative, but didn't describe the collection or analysis of data were labeled as "descriptive" and a handful of papers

that were structured primarily to make an argument, we labeled as “expository.” Descriptive and expository papers helped us see trends in practices and attitudes across the field, but not the impact of those practices. We analyzed the audiences, types of interventions, and the impacts that were intended, measured, and achieved for the 100 empirical studies that took place in ISL institutions. Below, we look at Biden’s four priority areas and highlight some of the strengths, gaps, and opportunities that those studies suggest.

1. Climate change

“Climate change is the challenge that’s going to define our American future.” --Biden-Harris Transition plan

Science centers and museums have a coveted spot in the conversation about climate change. Over the past 20 years, the number of projects on climate change has contributed to a body of literature reported in sources as diverse as the *Journal of Museum Education*, *Journal of Interpretation Research*, and *Journal of Microbiology & Biology Education*.

One particularly robust body of research is building around communication and interpretation techniques, often drawing on social science or science communication. For example, the National Network of Ocean and Climate Change Interpreters (NNOCCI) was created as a partnership among the FrameWorks Institute, New England Aquarium, the American Zoological Association, the Woods Hole Oceanographic Institute, and Knology to develop communication strategies about climate change. Evaluations of this project note a growth in visitor knowledge and motivations within participating institutions (Bunten & Arvizu, 2013; Fleischer, 2013; Fraser & Rank, 2012; Geiger, et al., 2017; Pope & Selna, 2013).

While a significant number of studies reported gains in visitors’ understanding of the causes and the impacts of climate change, and a commitment to engage in behaviors that minimize impacts on the climate, we did not find any studies which documented changes in behavior because, as one stated, “any changes would occur after data collection ended” (Parker, Cockerham & Ross, 2018). A few studies explored climate change in a societal as well as environmental context, drawing attention to issues of equity as well as the economic and political impacts.

Building on the success of collaborations across STEM institutions, partnerships with non-ISL organizations could broaden the audiences and knowledge bases of both science and non-science organizations in addressing climate change.

2. Racial Equality

“The moment has come for our nation to deal with systemic racism.” --Biden-Harris Transition plan

The exhibition *Race Are We So Different?* was mentioned in a number of studies, and the website suggests that a longitudinal study of the impacts of the exhibit (“Race Ahead”) is underway. The exhibit was one of the few examples we found where a complex social issue was addressed transparently in the context of other societal variables (e.g. economic disparities, education structures, and in some local versions of the exhibit, incarceration rates) and where STEM was embedded directly in the messaging and the evaluation. The summative evaluation (RK&A, 2007), conducted at the Science Museum of Minnesota and the Charles H. Wright Museum of African American History, found that visitors were engaged in the science content *and* in the social issues presented around the construct of race. The science section of the exhibit experienced the highest number of stops by visitors and “most notably, the exhibition had a statistically significant impact on the way visitors conceived of the idea of race.”

There were many other studies in ISL institutions that mentioned race, primarily in context of the demographics of audiences, but few examining race in the context of the societal structures and histories in the U.S.

The apparent successes of the *Race Are We So Different?* exhibit could argue for also addressing complex social issues related to gender identities, another construct that science museums use to describe audiences but have largely avoided addressing in detail (Morrissey & Dirk, 2020).

3. COVID-19

“The American people deserve an urgent, robust, and professional response to the growing public health and economic crisis caused by the coronavirus (COVID-19) outbreak.” --Biden-Harris transition plan

Although one prescient study examined public understanding of viruses and vaccines (Diamond, et al., 2016), most of the health-related projects in the studies we reviewed more often focused on the mechanics of the body and on maintaining an individual’s health. And yet, the events of 2020 have underscored how an individual’s health is impacted by societal structures, including political power, access to health care, trust in experts, social inequities, transportation, employment and other topics. One particularly relevant area of work is around socio-scientific topics and public deliberation (Chin & Reich, 2007; Kollmann et al., 2013; Kollmann et al., 2015), identifying successful interpretive approaches or programming structures such as

dialogue forums to engage the public in considering health in a broader societal context.

Building on the significant body of previous work around *individual health*, museums have a significant opportunity to more broadly address issues, choices, and policies related to public health. One particularly relevant area of work is around socio-scientific topics and public deliberation, largely led by the Museum of Science, Boston (Chin & Reich, 2007; Kollman et al., 2010; Kollmann et al., 2013; Kollmann et al., 2015). This research is identifying a range of interpretive approaches and programming structures that may be particularly useful for engaging the public in choices around complex and controversial topics such as health care, end of life, and abortion to name just a few.

4. Economy

“This is the moment to imagine and build a new American economy for our families and the next generation.”

--Biden-Harris Transition Plan

The national economy is inarguably one of the most compelling forces influencing societal responses to most social issues – income disparities, immigration policies, corporate powers, incarceration rates, national debt, political campaigns and funding for higher education, to name a few. And yet, the mechanics of the national economy, and the agency that individuals have over the economy is rarely addressed in museums, other than ancillary recognition of the impact of issues such as climate change on the economy. There may be opportunities for future research and experimentation related to public understanding of the economy, as well as bringing economic expertise to the interpretation of other topics.

SITUATING STEM KNOWLEDGE AND WAYS OF THINKING WITHIN SOCIAL ISSUES

One part of our research is examining how STEM knowledge is embedded in projects that address social issues. As expected, we found a range of disciplines that fall within the broad category of “science,” primarily biology and environmental science. The papers are peppered with terms such as “science and scientific practices”, “physical science basics”, “science communication”, “popular science”, “nuclear science”, “environmental science”, “science of climate change”, “public engagement with science”, “earth science” and more. Collaborations and expertise were largely based in areas of sciences. Technology was often associated with technological advances (particularly around health) or as a tool for reaching audiences.

We found relatively few examples where engineering or math were deliberately articulated as a body of knowledge or a way of thinking. Our methodology may have limited

our ability to recognize examples of engineering or math, and clearly, principles of engineering and mathematics were evident in discussions about climate change, energy, health, and other topics. Yet, few projects explicitly denoted engineering or mathematics as disciplines or ways of thinking. We wonder what might happen if the field more directly discussed engineering as an approach to social issues or mathematics as a way to think about social issues.

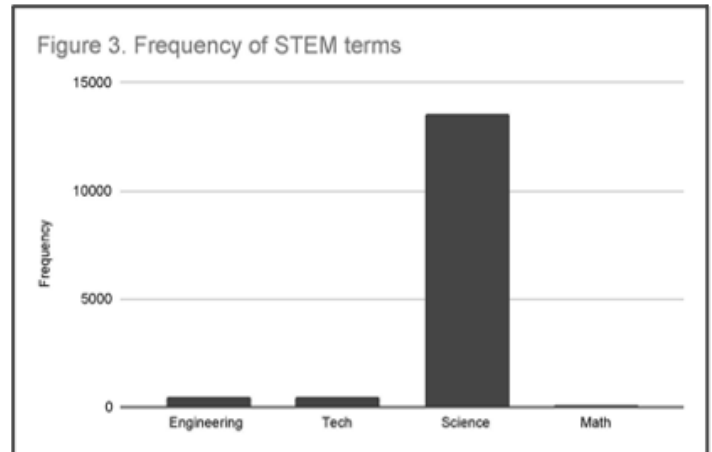


Figure 3. Frequency of STEM terms.

LOOKING AHEAD

The year 2020 was a watershed year for facing some of the most difficult social problems imaginable with racial unrest arising out of the disproportionate police killings of Black people, climate change induced wildfires, and a heated presidential election, all playing against the backdrop of a global pandemic and fed by mistrust of data and experts. Today, museums and science centers are facing excruciatingly difficult decisions about operations, messaging, budgets, audiences, missions, and basic survival. Every action and decision that museums make in the next few years will be a choice between turning inwards or turning outwards, between taking risks or moving towards safety, between focusing on traditional and popular topics or experimenting with more compelling and difficult topics. It is our hope that museums are at the center of the crucial conversations ahead of us.

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ON THE COVER:

Teenage students taking advantage of the solar viewing glasses made available by STAR Net for viewing the 2017 eclipse in the Georgetown County Library System, South Carolina. Learn more about public libraries and their response to COVID-19 starting on page 7.

