Co-Creation in Practice

Literature Summary

Fall 2017

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CONTENTS

Introduction .............................................................................................................................. 3
Theories Behind Co-Creation .................................................................................................... 5
  Collective Impact .................................................................................................................. 5
  Co-Design .......................................................................................................................... 7
  Community Engagement ...................................................................................................... 9
  Participatory Engagement ................................................................................................. 9
Co-Creation Basics .................................................................................................................. 11
  Motivations for Co-Creating in Museums ........................................................................ 11
  Three Types of Co-Creation ............................................................................................... 11
Benefits of Co-Creation ......................................................................................................... 16
  Co-Creation as Career Preparation ................................................................................... 16
  Co-Creation as Empowering Pride/Social Cohesion ......................................................... 17
Challenges of Co-Creation .................................................................................................... 19
  Agendas and Planning ....................................................................................................... 19
  Communication and Power Dynamics .............................................................................. 19
  Power Imbalances in Co-Creation ..................................................................................... 21
  Power Struggles in Co-Creation ....................................................................................... 23
Designing Co-Creation Spaces ............................................................................................. 25
  Setting ............................................................................................................................... 25
  Museum Staff Team .......................................................................................................... 27
  Communication Guidelines ............................................................................................... 27
Federally Funded Latinx/Indigenous Co-Creation Projects .................................................. 29
  STEM Activities ................................................................................................................ 29
  Makerspaces ...................................................................................................................... 30
  Professional Development Initiatives ............................................................................... 31
Citations ................................................................................................................................ 32
Introduction

In the Museums as a Site for Social Action (MASS Action) Toolkit, the Oakland Museum of California cites the following as the stages of collaboration:

“This system was originally adapted, from the Public Participation in Scientific Research (PPSR) project developed by Rick Bonney and the Cornell Lab of Ornithology, by Kathleen McLean as part of a 2008 National Science Foundation proposal for the new Gallery of Natural Sciences at OMCA. In 2009, McLean elaborated and customized this system for the Natural Sciences Gallery exhibit development team, that included Christine Lashaw and Evelyn Orantes, community engagement specialists. Since then Lashaw, Orantes, and other staff have evolved the three Cs at OMCA to be defined as a spectrum of activity that moves from less to more community involvement and sharing of authority. There is not a formula that prescribes how categories are attributed. Each exhibition project is different and has different needs.

Contribution:
Visitors and community members “contribute” by advising, loaning something, writing a response, attending a single meeting/convening or answering interview questions. The internal team conceives of and drives the vision and goals for the project. Community voice may or may not be incorporated.

Collaboration:
Community members and museum staff work together as a team, to develop ideas and share some decision-making. Community voice is visible in key moments of the project/exhibition.

Co-creation:
Community members or artists are part of the key decision making. This could be creative direction, designing elements for the project/exhibition, creating an artwork, adding interpretation, producing a media experience, or designing a whole section—determining the “how” an exhibit experience is implemented. Co-creators play a role throughout the whole project/exhibition. Community voice is a key piece of the narrative and is visible throughout the whole project/exhibition.” (Lashaw & Orantes 2017:106)

These stages have helped OMCA guide their exhibits and projects in order to develop relevant experiences for their visitors (Lashaw & Orantes, 2017).

The following literature review will discuss co-creation, the rarest of the above forms of engagement to be practiced by museums. It is worthwhile to note four things before moving forward.
First, there are a few basic, underlying engagement values required at every step of the co-creation process: respect, trust, communication, and commitment. These values are required from both the museum to the participants and vice versa; they are highly interrelated and a deficit in one area will impact the strength of the others (Example #1: A museum’s lack of communication makes community group feel they don’t respect them; Example #2: A community group’s lack of communication makes museum worry about whether they’re really committed to the project). Community co-creation initiatives with an absence or shortfall of these values are liable to experience greater difficulties when attempting to co-creatively collaborate (Lynch, 2011; Safo et al., 2016).

Almost every piece of literature on community models and co-design practices reference the importance of these values. For example, Rodgers (2017) discusses the inherent importance of respectful and empathetic speech when co-designing with people living with dementia. The Roots of Wisdom team cultivated a deep network of trust by committing themselves to their partner communities and demonstrating respect for their partners by following through with those commitments (Roots of Wisdom Project Team, 2016). Moreover, several health and social service organizations— such as the San Francisco Department of Public Health (Aragon & Garcia 2015) and the Participatory Sustainable Waste Management (PSWM) Project in Brazil (Tremblay & Jayme, 2015)— report the vital role respectful communication played in allowing them to fully connect with their chosen communities.

Second, it is vital to honestly converse with stakeholders to learn their desired level of collaborative involvement before commencing a project in partnership with a community (Koster et al., 2012). Projects that don’t take this into account may not succeed if the participants do not have the time or energy to take on the responsibilities and tasks the project requires of them.

Third, while OMCA has very clearly defined term for co-creation, a review of existing literature revealed that other organizations use the term ‘co-creation’ for a variety of projects. Keeping in mind the different ways museums are exploring co-creation with their audiences will help us gain a better understanding of how we can improve upon existing co-creative practices.

Lastly, the term “co-design” is often used interchangeably with “co-creation”. A brief description of “co-design” will be provided in the section titled ‘Co-Design’.
Theories Behind Co-Creation

Collective Impact

Mark Kramer and John Kania first coined the term collective impact in a Stanford Social Innovation Review article in 2011, defining it as “a long-term commitment by multidisciplinary partners to address a specific social problem”. The framework is designed to tackle deeply entrenched and complex social problems using a highly structured, long-term, cross-sector partnership approach.

Kania and Kramer (2011) state that collective impact (CI) requires:

1. A centralized infrastructure
2. A dedicated staff operating as a backbone support system
3. A common agenda
4. Shared measurements in order to pool evaluation resources and ensure all partner organizations apply the same standard
5. Continuous communication
6. Mutually reinforcing activities among all participants

Groups that have implemented CI include universities, such as the University of New Mexico’s Unidos Project (De León et al. 2015); health and social services, such as the San Francisco Department of Public Health (Aragon & Garcia 2015); and informal STEM education organizations, such as spectrUM Discovery Area (Truitt 2017b) and Fleet Science Center (Aguirre 2017).

The Collective Impact Forum (2014), a leading collaborative network for CI practitioners, defines the following as the main principles of collective impact:

- Design and implement the initiative with a priority placed on equity.
- Include community members in the collaboration.
- Recruit and co-create with cross-sector partners.
- Use data to continuously learn, adapt and improve.
- Cultivate leaders with unique system leadership skills.
- Focus on program and system strategies.
- Build a culture that fosters relationships, trust and respect across participants.
- Customise for local context

See link for more details on the Collective Impact Forum: https://collectiveimpactforum.org/what-collective-impact

Strikingly, a research study on the practical application of the CI framework for community collaboration found that the only significant predictor of successful collaboration within a collective impact-informed engagement approach was the strength of informal relationships (Gillam, Counts...
Garstka 2016). These developed bonds of trust between communities and organizations “enable participants to have difficult conversations, create a sense of shared purpose, and help collaboratives weather the storm in the face of uncertainty” (Gillam et al. 2016:220).

Because its applications are vast, collective impact is not limited to co-creation-based activities. However, one group of researchers believe that co-creation should be the natural evolutionary future of all collective impact initiatives and state: “as the initiative evolves, leaders should continue to assess how they can move their work toward the co-design level where possible to ensure that efforts truly include community members” (Raderstrong & Boyeau-Robinson 2016:187).

One downside of collective impact is that, due to its recent inception, there is a lack of published information on the evaluation of collective impact-framed projects. Christens & Inzeo note that “although work has begun to establish a field of collective impact evaluation, these efforts have so far been very general and do not yet report findings from empirical data” (2015:426). The absence of CI self-evaluation is backed by LeChasseur who found in a case study analysis of two exemplary CI projects that neither mentioned any sort of “self-reflective inquiry” practices within their disseminated materials (LeChasseur 2016:232).

It is also important to note that in practice, collective impact initiatives can be extremely top-down. This can unwittingly reinforce tokenism and social inequalities by not giving community members enough (1) influence over decisions that are made or (2) spaces to speak and be heard (LeChasseur 2016; Raderstrong & Boyeau-Robinson 2016). Raderstrong & Boyeau-Robinson offer two tips for decreasing top-down tendencies in the practical application of the collective impact model:

First, amplify the voices of community members. The role of informal relationships comes back into play here. In order to create an atmosphere in which community members feel able to authentically contribute and engage in decision-making, the relationships between residents and CBOs (and the relationship between the CBOs and the leading organization) must be strong. Moreover, community members must be encouraged to identify themselves as the context experts that they are (Raderstrong & Boyeau-Robinson 2016:188). Another way to amplify community voices is use an Asset-Based Community Development tool to discover existing skills and passions that can be built upon (Raderstrong & Boyeau-Robinson 2016:189).

Second, integrate feedback from community members. This means creating and implementing a real, true feedback loop that will keep the project engaged with community members, and vice versa, over time (Raderstrong & Boyeau-Robinson 2016:190-191)

Looking at the Unidos Project, a community organizing initiative spearheaded by the University of New Mexico, one can see the potential of the collective impact framework. The project was intended to (1) empower and support Latino students and (2) tackle systemic barriers to Latinx
engagement in the New Mexican educational system. As of 2015, over 80 community partners remained consistently engaged in the project.

A major challenge was to create an atmosphere in which community members desired to personally commit to or participate in the Unidos Project, at any level, to benefit their community and Latino student success. Even though educational challenges in New Mexico heavily impacted a large segment of the population, research showed that no large-scale coordinated attempt had ever been successfully made. This was, in part, due to the inability of the prior attempts to unite the diverse political, cultural, and community-based groups within the state against this social issue. Project leaders determined that collective impact would be an ideal project framework. The Unidos team began by identifying the strengths of the broad New Mexican communities in order to better adapt the CI model to New Mexico's unique challenges. A primary strength was revealed to be shared Hispanic values, chiefly the cultural importance of *familia* and *respeto*. Hinging the model around these values “minimized individually-focused agendas and power grabs” and resonated so strongly with the statewide community that they “not only drove the work, but were recognizable and attracted others who then joined the movement” (De León et al. 2015:15).

Project leaders also chose to use the metaphor of an *acequia*—a centuries-old and community-operated irrigation water delivery system native to New Mexico—to guide the shared agenda of reforming educational pathways and encouraging academic success. Re-framing the CI model in this unique and culturally relevant manner led to “a sense of mutual responsibility and investment among partners [being] developed rather than superficially imposed from the top-down” (De León et al. 2015:5).

The only lacking portion of this specific project as a case study is that the Unidos Project final report, *Community Organizing on Behalf of Latino Student Success: A Case Study of the Unidos Project in New Mexico* (from which the above information was gathered) did not mention go into specific details on how the project’s model was evaluated (De León et al. 2015). This is, as stated above, is a common issue in CI-framed projects.

**Co-Design**

Below is some basic information on co-design. Full details on the origin, history, and applications of co-design specifically are not explored as the focus of the literature review was primarily on ‘co-creation’. A recommended starting point for further reading on this topic is the journal *CoDesign* by Taylor & Francis. Further lit searches on this topic can be conducted as needed.

Co-design is sometimes (but not always) referred to as ‘participatory design’. There are differences in the terms that can be explored further if needed. See the section titled ‘Participatory Engagement’ below for a little more on participatory design.
Co-design is sometimes also called co-development or co-creation. These terms are slightly more interchangeable with 'co-design' than 'participatory design', but there are still slight differences that can be clarified as needed.

The purpose of co-design was originally commercial in nature and was promoted as a response to the 'experience economy' shift. Businesses decided to bring end-users into the design process with the intent of creating more innovative and relevant products for the market (Sanders & Stapphers 2008; Prahalad and Ramaswamy 2004). Nonprofit organizations began applying co-design theory for a similar purpose, with the output tending to be a service/program/exhibit rather than a product.

Four primary co-design models as referenced by Greenhalgh (2016) are:

- **Value co-creation**: Focused on creating or enhancing the economic and social benefits of product/service. Used in commercial and non-profit settings, with some university applications.

- **Experience-based co-design**: Emphasizes phenomenology, collective sense-making and negotiations, etc. Primary application is as a pragmatic tool for improving services. Used in commercial and non-profit settings.

- **Technology co-design**: Emphasizes participatory and common-sense practices. Has effective design processes but logistical difficulties with sustainable follow-through. Most commonly used by commercial businesses.

- **Community-based participatory research (CBPR)**: Emphasizes power sharing, reciprocity, and mutual learning between research group and partner organization. Most commonly used in university or research settings, with some application by nonprofits.

Museums seem to merge one or multiple of the above co-design models with either the collective impact framework (*see details on spectrUM and Fleet Science Center*) and/or the community conversation process (*see details on Explora*) to better meet their project needs. Other nonprofit examples of co-design are:

**Alzheimer's Scotland**

Teaming up with Alzheimer's Scotland, researchers used co-design to challenge widespread negative assumptions about people living with dementia by involving people with dementia as partners in a creative process that facilitated the independent design of a tartan design by each participant. The Scottish population voted on the completed designs, with the winning pattern becoming the official tartan design of the Alzheimer’s Scotland charity (Rodgers 2017).
Conversations with the Earth

*Conversations with the Earth* is an international project founded by Land is Life (an international Indigenous-led advocacy and education organization for the rights of Indigenous Peoples), InsightShare (a leading organization in the use of participatory video as an experiential tool for individuals and groups to grow in self-confidence/trust and build skills to act for change) and Conversations du Monde (a group focused on promoting oral tradition and cultural awareness by creating quality multimedia exhibitions). They collaborate with Indigenous communities to appropriately represent the communities’ stories, concerns, and adaption strategies relating to climate change through participatory media. ([http://stories.conversationsearth.org/about/](http://stories.conversationsearth.org/about/))

Design for Health and Wellbeing Lab (Auckland, New Zealand)

Design for Health and Wellbeing Lab offers a space within a hospital for visitors, patients and staff to drop by with problems that need to be solved (negative interior design, wayfinding, etc.). Lab participants then use the space to brainstorm and prototype solutions to the problem in an economical way (Reay, Collier, Kennedy-Good, Old, Douglas & Bill, 2016). Their handbook is a rich resource of tools and methods for their collaborative process of discovering the issue, defining the crux of the problem, designing a solution and delivering it in such a way that encourages feedback and evaluation by real time users (Design for Health and Wellbeing Lab, 2017).

Community Engagement

This is a very broad and dense topic. Oftentimes community engagement techniques are listed in co-creation or participatory engagement literature. Several community engagement handbooks were identified in reviewing the literature, but they do not directly apply to the three co-creation types. Many community engagement toolkits and handbooks are focused on the health industry. Community engagement resources identified are listed in the co-creation tracker .xls. More can be researched on this area as needed.

Absent from community engagement handbooks are conversations or conversations around how much control organizations are willing to relinquish in order to develop a truly shared authority in co-creative projects with community partners and individuals. A separate literature review may be needed to further explore this area.

Participatory Engagement

Below are some basic details about participatory design and participatory engagement strategies. This model is often tightly interwoven with co-creative practices; many sources cited in the co-creation sections later in this review are from participatory engagement literature.
The participatory engagement model has been exponentially popular over the last few decades as museums sought to bring more authenticity into their exhibits to make art, history and/or science more relevant for their audiences (Simon 2010; Simon, 2014).

Participatory engagement models often use participatory design principles. Articles sometimes refer to ‘participatory design/engagement’ as being the same as ‘co-creation’. This is a bit misleading, as participatory engagement is mostly limited to engaging visitors in a one-time experience rather than a collaborative, long-term project. In reality, co-creation within a participatory engagement model tends to be limited to practices that allow visitors to interact with the planned exhibit in a creative manner (such as crowd-sourcing content, commentary walls, etc.) or influence the development of the exhibit (creative workshops, focus groups, advisory panels, etc.) without taking on any deeper responsibility/control of the project (Seriff 2016; Gibson & Kingdon 2013; Green et al. 2016).

Several excellent examples of strictly ‘participatory engagement’ projects can be found in Visitor Voices in Museum Exhibitions (ed. McLean & Pollock 2007).
Co-Creation Basics

Motivations for Co-Creating in Museums

Motivations for co-creation revolve around the desire to:

A. Create socially-relevant and culturally-competent exhibitions that reflect multiple perspectives (Bunning et al., 2015; Gibson & Kindon, 2013; Orantes, 2010; Roots of Wisdom Project Team, 2016; Simon, 2010; Stanley, 2017; Wippoo & van Dijk, 2016)
B. Design programs or exhibits that nurture empathy and/or promote social cohesion (Gibson & Kindon, 2013; Green et al., 2016; Creative Museum Project, 2014; Green et al., 2016; Myrow, 2017; Simon, 2017; Wippoo & van Dijk, 2016);
C. Create culturally-competent informal education programs that will inspire learning, creativity and innovation (Bowen, 2007; Truitt, 2017; Orantes, 2010; Aguirre, 2017; Leigh, 2017); and (4) uplift and create lasting relationships with local communities (Orantes, 2010; Truitt, 2017; Bunning et al., 2015; Green et al., 2016; Simon, 2010; Myrow, 2017).

Three Types of Co-Creation

Co-creative projects tend to fall into one of the following three categories: co-creation as an exhibit/program experience, co-creation to design culturally relevant programming, and co-creating exhibits/exhibitions within the museum space.

1. Co-creation as an exhibit/program experience
Co-creating in this sense is meant to “engage visitors as contributors to exhibitions and active participants in museum conversations” (McLean & Pollock, 2007:1). Projects applying this style of co-creation tend to use participatory design methods to encourage visitors to creatively interact with or add to exhibitions (Simon, 2010; Bunning et al., 2015). This has been practiced to great success by many museums such as (but not limited to) the Santa Cruz Museum of Art and History (Simon, 2010), the Museum of International Folk Arts’ Gallery of Conscience (Green et al., 2016), the Ontario Science Centre (Bowen, 2007), and the Natural History Museum of Los Angeles County (Stevenson et al., 2009).

Projects utilizing this style of co-creation rarely give final decision-making control of exhibit theme selection or programmatic goal-setting to participants (Bunning et al., 2015; Gibson & Kingdon, 2013; Lynch, 2011). Rather, museums set up dedicated spaces in which visitors can engage in design thinking practices that let them shape, re-direct or offer feedback on exhibits after curators or other staff have decided the exhibit motivation, theme, focus, format and/or goals.
Penn Museum (Philadelphia, PA)
A one-year experimental space called the “Idea Lounge” was designed to present prototype display items (actual objects, interactives, or videos) or signage for upcoming exhibitions to visitors in order to gather their feedback and ideas (Stanley, 2016). Feedback activities ranged from a simple opinion survey, to voting on which version of an exhibit element works best, to responding to prompts that encourage them to creatively explore what they would like to see or experience at the Penn Museum in the future. Museum staff decide what is placed into the Idea Lounge. (https://www.penn.museum/blog/museum/the-idea-lounge/)

Indianapolis Museum of Art (Indianapolis, IN)
Mobile stations and pop-up spaces were created to involve visitors in user testing (Hellmuth et al., 2016). As a participatory engagement method it was very successful and fit excellently with the museum’s formative exhibit evaluation efforts. However, it was still the museum which chose the ideas. Visitors were only involved in the brainstorming and prototyping stages in order to help the museum make informed decisions. (http://mw2016.museumsandtheweb.com/paper/a-seat-at-the-table-giving-visitors-a-voice-in-exhibition-development-through-user-testing/)

Ontario Science Centre (Toronto, ON, Canada)
Teenagers (14 - 16 year old) were invited to engage in brainstorming, prototyping and developing activities for their Agents of Change initiative, which was geared towards “developing audience experiences that encourage the attitudes, skills, and behaviors needed for innovation” (Bowen, 2007, p.134). Workshop outcomes impacted exhibit design in the museum.

A similarity between all three is that there is limited (if any) community partner engagement-- all the co-creation is happened between the visitors and the museum. Co-creation that involves only participatory engagement within the above context also falls short of in-depth community co-creation in that the museums tend to be pursuing engagement to achieve their own agendas (such as increased audience engagement) rather than those of the communities they are engaging (Bunning et al., 2015; Lonetree, 2006; Ng et al., 2017).

2. Co-creation as a means to design culturally relevant programming
Co-creation for culturally relevant programming is deeper than co-creation for participatory exhibits in that there tends to be more community conversations and partnership involvement during the design stages of the project. This style of co-creation leans more towards the collective impact framework (see ‘What is Collective Impact section below) or the community conversation process developed by the Harwood Institute for Public Innovation. These programs also tend to be bilingual or multilingual, depending on their geographic regions, and occur offsite from the museum.
**Explora (Albuquerque, NM)**
Explora staff worked with the nonprofit Partnership for Community Action to design *Explora Ingeniería*, an engineering-focused program that was facilitated in Spanish (Leigh, 2017). (Article does not have much information on their process.) They also utilized the community conversation process and currently have an IMLS grant to develop a toolkit for sensory-friendly museum activities and a community co-creation process with the New Mexico Autism Society (https://www.imls.gov/grants/awarded/mg-10-16-0079-16) (Leigh 2017). [NOTE: The article which refers to this project as being co-created discusses the OUTPUT rather than the process, so whether or not the process was co-created in the sense that we are researching is undetermined.]

**Fleet Science Center (San Diego, CA)**
The goal of the Fleet’s push towards more culturally relevant public programs was to (1) increase science knowledge and engagement within the local Chicano community and (2) deepen relationships with residents. The Community Engagement Manager followed the collective impact model to learn what the community wanted and then built a network to support that need. He also created a leadership group whose specific task was to communicate regularly with the community. The success of the new approach led to (1) partnerships with 60+ community-based organizations and businesses and (2) maintained attendance numbers while broadening the museum’s audience. They are now in the process of handing over the project to a local organization that will be able to support the long-term sustainability of the program. [NOTE: Info was collected in an in-person meeting with the Fleet’s Community Engagement Manager. Contact Meghan if more info is desired.]

**The Gallery of Consciousness at the Museum of International Folk Art (Santa Fe, NM)**
MIFA aligned with two local CBOs, Youth Media Project (YMP) and ¡YouthWorks!, to engage with and support local at-risk youth communities through digital storytelling and poetry workshops. The program was based around the theme of immigration, which was the focus of the MIFA Gallery of Conscience’s *Between Two Worlds* exhibit. Project goals were to (1) build community between students and artistic professionals; (2) generate content for exhibit installations/public programs/etc.; and (3) give underrepresented community members a chance to share their voices and experiences with the general public in order to put a personal face/offer multiple perspectives on a contemporary issue and foster empathy and understanding. (Green et al. 2016)

**spectrUM Discovery Area (Missoula, MT)**
spectrUM, an organization that is linked to the University of Montana, developed a deep relationship with the local tribal reservation through a co-creative advisory team called SciNation on the Flathead Reservation (SciNation) (Truitt, 2017b). spectrUM collaborated closely with the SciNation team to design STEM programs that would be for the local tribes by the local tribes. Their project culminated in increasing the presence of Native STEM role
models at their community events and designing hybrid maker projects that combine indigenous craft technology chosen by SciNation (e.g. beading, drum-making) with technology like 3D printing and laser cutting (Truitt, 2017b). SpectrUM’s funding sources increased over 3x after implementing their new co-creative collective impact model (Truitt, 2017a). They will soon begin conducting a longitudinal study and are seeking to create a consortium of co-creation-minded institutions.

The final goal for this style of projects is sometimes the eventual bestowing 100% of program operations to a community-based organization that can guarantee the longevity of the program (Aguirre, 2017; Truitt, 2017a). For example, the Fleet Science Center is working with a local community-run institute to take on its 52 Weeks of Science program (Aguirre, 2017). The Maker Truck being designed by spectrUM Discovery Area will not be owned by spectrUM, but by the tribal community for which it is being made—even the license plate is already registered to the reservation (Truitt, 2017a). This is because (1) the intent of this mode of co-creation is to facilitate the creation of something for the community itself and (2) it is very difficult for museums to gather sustainable funding for permanently ongoing co-creation initiatives.

3. Co-creating exhibits/exhibitions within the museum space
Another type of co-creation is one in which partners/participants shared ownership in the project by influencing the project focus and goals, designing and prototyping the activities/exhibit(s) and/or choosing what results are or are not disseminated. This is an in-depth process requiring a high level of facilitation on the part of museum staff. Museums which have co-created exhibits with community-based organizations often cite a deep sense of mutual trust and respect built up over time as being key to their collective success.

Te Papa Tongarewa (Wellington, New Zealand)
Te Papa, the national museum of New Zealand, partnered with refugee youth communities in Aotearoa/New Zealand to co-create an exhibit titled The Mixing Room: Stories from young refugees in New Zealand. Participants were given a focal point (their experiences as refugees in New Zealand), staff support, and the agency to determine the thematic content of the exhibit. Much work went into ensuring the project would not negatively impact participating youths’ academic or home lives, and the museum worked closely with partner organizations to legitimize the students’ involvement and ensure their safety throughout the project (Gibson & Kindon, 2013). In a thoughtful review of the project, authors admitted that “the challenge for Te Papa is to move co-creation beyond content only to full participation in all aspects of exhibition development when working with communities” (Gibson & Kindon, 2013, p.81). On reflection, the Te Papa project staff stated that they felt they were able to get emotional/financial backing from the institution “partly because senior management wished for a ‘shake-up’ of the Community Gallery space, and partly because the research findings for participatory action were so compelling” (Gibson & Kindon, 2013, p.80).
Santa Cruz Museum of Art and History (Santa Cruz, CA)
The museum co-created an exhibit titled Lost Childhoods: Voices of Santa Cruz County Foster Youth and the Foster Youth Museum with over 100 artists, foster youth, and youth advocates—a group that they called their Creative Community Committee (C3) (Myrow, 2017; Simon, 2017). The SCMAH also has a history of other co-creative programs under the leadership of their current director, Nina Simon.

Oakland Museum of California (Oakland, CA)
OMCA partnered with youth organizations to explore the interests and issues of local teens by experimenting with co-creation/collaborative processes. Teenagers were invited to create a “cultural and historic counterpoint” to the 50s-era retrospect exhibition Birth of the Cool. The final exhibition, Cool Remixed: Bay Area Art and Culture Now, included installations and individual artworks from the youth, and “everything from section titles to the curatorial statement was inspired or created by youth” (Orantes, 2010, p.25). [NOTE: While OMCA did formative and summative evaluations of this exhibit, the article reviewed did not discuss whether there was an assessment of the co-creation process itself.]

Oregon Museum of Science and Industry (Portland, OR)
OMSI participated in a powerful, collaborative co-creation project called Roots of Wisdom. The project goal was to design an exhibition that discusses traditional ecological knowledge (TEK) and western science within culturally relevant contexts to demonstrate how they are valuable and complementary ways of knowing, understanding and caring for the world (Roots of Wisdom Project Team, 2016).
Benefits of Co-Creation

Co-Creation as Career Preparation

TrendsWatch 2016 noted that professional demands are being “radically reshaped by technology, culture and economic forces” (Center for the Future of Museums, 2016, p.8). Competition for jobs and cutbacks in several industries have increased the difficulty of acquiring stable positions that offer livable wages (Center for the Future of Museums, 2016). Most interesting is that an IBM survey of top CEOs across the globe reported that the most sought-after quality for success in dealing with the complex situations of today’s world is creative and innovative thinking (IBM, 2010).

Free-choice learning environments such as museums are perfectly positioned to craft unique, creativity-based projects that help students practice core skills, like synthesizing new information into meaningful knowledge, and gain confidence to explore “[their] own pathway of lifelong learning” (Falk & Sheppard, 2008, p.144). Experiences that bolster self-confidence can also increase an individual’s sense of self-efficacy, which plays a powerful role in their decision-making by acting as “a filter to determine what is worth engaging in again” (Falk, 2009). In discussing acts of creativity as supportive of self-efficacy, psychologist Albert Bandura notes, “Innovativeness largely involves restructuring and synthesizing knowledge into new ways of thinking and of doing things...But above all, innovativeness requires an unshakeable sense of efficacy to persist in creative endeavors. “ (Bandura, 1997, p.239).

Co-creation, an experience that requires participants accept responsibility and a shared ownership, is an opportunity to involve youth in a project that offers a safe, dynamic space to explore their talents, gain new skills, and build their self-confidence/pride in their abilities and identities (Gibson & Kindon, 2013; Green et al., 2016).

An example can be seen in the development of the artistic skill by students who participated in the co-creative workshops at the Museum of International Folk Arts (MIFA) in Santa Fe, New Mexico. MIFA partnered with two local CBOs, Youth Media Project (YMP) and ¡YouthWorks!, to achieve their collective goal of engage with and support local at-risk youth communities through digital storytelling and poetry workshops based around the theme of immigration, which was the focus of the MIFA Gallery of Conscience’s Between Two Worlds exhibit. Project goals were twofold: (1) to build a community between students and artistic professionals that would provide academic and professional experience to the youth and (2) generate exhibit/program content for MIFA in which community youth could share their voices with public in order to offer multiple perspectives on a contemporary issue and foster empathy/understanding (Green et al., 2016). In this way, aspiring poets and artists were able to develop their skills alongside professional individual such as a local poet laureate, Hakim Bellamy.
Co-Creation as Empowering Pride/Social Cohesion

As spaces where co-creation can be practiced, museums can be the type of welcoming and creative forums that act as a catalysts for helping individuals become proud of their identities and social representations (Sandell 2007).

Co-creation recognizes and celebrates the creativity of the individual by acknowledging through action that every person has something special that can “enhance understanding between the different worlds we inhabit” (Wippoo & van Dijk, 2016, p.5). Recognizing the creative power of the individual encourages the building of self-confidence and pride in one’s identity. This, in turn, empowers individuals to be confident in their ability to uplift their communities.

One study that documented the impact of community engagement projects on individuals and communities found that such projects led to mutually beneficial results. Individuals experienced an increase in self confidence and self esteem, personal empowerment, and social benefits such as getting to know others in their neighborhood and getting involved in local organizations (Attree, French, Milton, Povall, Whitehead & Popay 2011). For the local community in which these individuals were active, the benefits included (1) increases in mutual trust and understanding among diverse groups and (2) an increased sense of the community as a better place to live (Attree et al. 2011).

A design project with the nonprofit Alzheimer’s Scotland used co-design to challenge widespread negative assumptions about people living with dementia by involving people with dementia as partners in a creative process; the outcomes “shed new light on the future possibilities for co-designed, creative and other interventions” for therapeutic purposes to improve mental and emotional health (Rodgers 2017:5). A post-project evaluation revealed that:

“Alzheimer Scotland staff members [the partner organization] considered there to be lasting impact for participants in the way the co-design sessions gave people confidence to try new things—some people had been worried about taking part but were very relaxed during the session. [...] Each participant’s sense of pride is palpable.” (Rodgers 2017:11)

The Participatory Sustainable Waste Management (PSWM) Project in São Paulo, Brazil worked with local residents who are *catadores*—those who collect recyclable items for a living. The *catadores* community is a loosely organized work group that has faced hardship due to being unrecognized/supported by government entities and stigmatized by other residents. The goal of the project was to use a participatory video process (PVP) to (1) reduce the stigma of working as a catadore/a by documenting their experiences through their own eyes and (2) to create a deliverable to use as evidence to support recycling programs and policies within the local and statewide government (Tremblay & Jayme, 2015). Working with three groups of Facilitators taught three groups of participants how to plan, execute and edit film; the groups went on to create their own
short story movies. After the participatory video process was complete, participants self-selected to present their movies to government agencies, provide information as subject matter experts of the recycling industry, and voice the concerns of the catadores community. (Tremblay & Jayme, 2015).

The most powerful short-term outcomes were "an experience of strength [for the recyclers] as a group to improve their livelihoods and validation of their knowledge" (Tremblay & Jayme, 2015, p.308).

Co-creation can also be used as a tool to strengthen social ties. This makes these activities especially powerful for children and teenagers, who are still developing self-confidence and a sense of their role in the social world. As one researcher argues, "only by establishing roots and making commitments to their communities can youth begin to envision long-term membership in the local as a concrete option for them" (2004, 727). At the Museum of International Folk Arts, co-creation brought about a strengthening of bonds between youth from highly diverse backgrounds:

*Gallery of Conscience, Museum of International Folk Arts, New Mexico, USA*

"Reflecting the community where they live, ¡YouthWorks! cohorts [partner for the Between Two Worlds exhibit hosted at the MIFA Gallery of Conscience] are composed of Hispanic, Latino, Native American, and Euro-American students. Endemic to this social landscape and its complex history is a tension that can arise among members of these cultural communities. During planning meetings, ¡YouthWorks! staff related that students often come into a new cohort with preexisting biases toward classmates from other cultural communities, a microcosm of the larger social context. Often, however, they quickly develop a sense of solidarity, recognizing that their shared experiences and goals are more compelling than their differences." (Green et al., 2016, p.11)
Challenges of Co-Creation

Agendas and Planning

Backlashes may occur when organizations pursue co-creation to achieve only their own agendas rather than those of the communities they are trying to engage (Bunning et al. 2015; Lonetree 2006; Ng et al. 2017). This is particularly true when the projects’ purpose is to increase audience diversity, as these activities (despite being labeled “participatory”) are often too shallow to build a meaningful connection between community and museum:

“...When examined closely, these initiatives often reveal hidden problematic power dynamics that actually maintain the status quo. For example, an analysis of an education program for Dia de los Muertos (Day of the Dead) that specifically targets Latinx audiences can actually reveal how, implicitly, the museum centers white audiences every other day of the year. [...] Diversity and inclusion work can be shallow or tokenizing – with the potential to re-inscribe and perpetuate white supremacy and oppression, even if the intention is to challenge it – or it can be transformative.” (Ng et al. 2017:143)

Co-created/participatory projects at museums can therefore be positive experiences for visitors, but only when the goal is clearly stated in a way that all can understand.

A 2016 review of co-creation literature revealed that principles of successful co-creation include (1) a systems perspective, (2) a creative approach to research/activities that is focused on improving human experience, and (3) careful attention to governance and process. If these principles are not followed, co-creation efforts may fail (Greenhalgh, Jackson, Shaw & Janamian 2016).

The need for creative approaches and a focus on careful planning is backed by work done by the Scottish Community Development Centre. Their perspective on community planning, as shared while discussing community engagement models, is that it ought to be

“...a mechanism to strengthen and sustain communities, rather than simply as an activity that the community should somehow be involved with. As such the key question is how can community planning engage with community issues and community change, rather than how can we engage communities in the community planning process.”
(Hashagen, 2002).

Communication and Power Dynamics

Why have many museum shied away from involving visitors more deeply in the collaborative process? Sanders and Stappers (2008) suggest that businesses often avoid co-design practices out of a few that these practice will threaten the existing status quo/power structures. They note that it
“is very difficult for those who have been successful while being in control to give it up now or to imagine a new way of doing business that can also be successful” (Sanders & Stappers, 2008, p.9). McMullen (2008) echoes this sentiment within the nonprofit field while writing about the evolution of collaborations between museum and indigenous communities:

“It is always easier to follow familiar processes, and museums are no different than other organizations. In beginning to engage indigenous people, museums employed them in areas marginal to interpretation such as performances and craft demonstrations, where they offered few challenges to museum authority structures, including curatorial interpretation. [...] But what happens when indigenous advisors and consultants do not accept roles assigned to them by museums and their infrastructures, when community agendas differ from those of museums, and when museums and consultants speak radically different languages in terms of frames of reference and what is at stake? The issue is not solely about what gets taught and who has the right to teach it, but also about why it may be important for indigenous people to collaborate with museums and how it fits into their vision of themselves and long-term goals for cultural persistence.” (McMullen 2008:61, 62)

On a positive note, younger generations seem to experience an easier time distributing and sharing ownership—an attitude shift that may be “largely possibly because the internet has given a voice to people who were previously not even a part of the conversations” (Sanders & Stappers, 2008, p.9).

Reluctance by museums to release the authority they have become accustomed to controlling does not go unnoticed by community partners. One 2011 summary report on community participation in twelve major UK museums and art galleries noted:

“Across the 12 organisations, there was a growing feeling of frustration, mainly (but not solely) articulated by the community partners, that engagement in these museums and galleries did not always ‘do what it said on the tin’. At an individual project and organisational level, the actual experience of engagement and participation frequently revealed a level of control, risk-aversion and ‘management’ by the organisations that served to undermine its impact and value for the ‘target’ participants.” (Lynch, 2011, p.11).

Another resource, compiled by the Science Museum of Minnesota, the Museum of Life and Science, and the Nanoscale Informal Science Education (NISE) Network discusses how crafting a strategic web of interconnected services to create a collective impact within a community relies upon the ability of the organizations to form and sustain collaborative relationships—in other words, they need an ecosystem of services and opportunities within a community. Museums have a role to play in conceiving and implementing programs that (1) address community needs and (2) enrich the lives of community members. They note that primary challenges to designing and supporting this ecosystem revolve around poor communication (which breeds unclear goals/expecations/purpose) and power struggles (McCarthy & Herring 2015). [For more see:
It is vital for museums to focusing on how collaborations and community involvement “fits into [the community’s] vision of themselves and [their] long-term goals for cultural persistence” (McMullen, 2008, p.62). Following familiar procedures because it seems easier for the museum disregards the ways in which those procedures may exclude or devalue the expertise and experiential knowledge of community members (McMullen, 2008).

In summary, co-creation takes the first step in the right direction for reducing the oppressive power structures that impede our ability to genuinely connect with minority communities. Releasing creative and decision-making control are actions that demonstrate how we as a museum value the inherent creative powers within each individual and seek to support our communities by offering spaces in which individuals can explore those powers (Wippoo & van Dijk, 2016; The Creative Museum Project, 2017).

A review of literature related to co-creation revealed two primary types of power issues: power imbalances and power struggles. The following section will discuss these two items. Resolution tactics for both tend to reflect to relationship management or resource management practices (Neal & Neal, 2011).

**Power Imbalances in Co-Creation**

Situations which cause power imbalances are (1) internal structures which give more authority to staff than community members, (2) poor communication that makes participants to feel they are being left out of unvalued, and (3) false perceptions of power imbalances based on preconceived notions (sometimes created by community members’ own feelings of lack of confidence while working with perceived authority figures from CBOs or other organizations) (Safo et al., 2008). Power imbalances seem to be able to be resolved internally by taking precautionary measures before beginning the collaboration.

One precautionary measure is for the museum to “acknowledge their position of power at the onset and commit to an equal partnership” (Safo et al., 2008). An interesting introductory practice that is currently promoted by modern community-based participatory research (CBPR, a co-design process) practitioners working to decolonize community research practices is called “location of self” (Absolon & Willett, 2004). Locating oneself when being introduced to a new person or group is a “cultural tradition that serves to identify who you are and your connections to the broader community” for several First Nations in Canada (Absolon & Willett, 2004; Koster et al., 2012). This practice seeks to de-mystify non-community members’ personalities, and involves sharing their personal context in order to ‘locate’ themselves in relation to the project (Absolon & Willett, 2004). By verbally deconstructing yourself within the context in the project, you are making an effort to
dissolve preconceived notions, ensure personal accountability by setting the tone of who you are at the beginning of the relationship, and build trust with community members (Koster et al., 2012). Examples of locating oneself are below (Koster et al., 2012, p.196):

“Kirstine (the community partner): On my maternal grandmother’s side, I am descended from England, and on my grandfather’s, I am First Nation. I have lived most of my life in Nipigon, Ontario. I knew very little about my First Nations culture until the birth of my son 18 years ago, when I decided to ensure he had an opportunity to learn about our people. For the past eight years I have lived on-reserve. I wish to continue volunteering in my First Nation to ensure our people regain and retain our cultural heritage, work collaboratively to ensure development within our community, and to ensure our treaty rights are not infringed.”

Rhonda (one of the researchers): I am a third generation Canadian of Austrian descent. I grew up on the Canadian Prairies in small agricultural towns where I learned the value of community and the importance of each individual’s contributions to that community. As a mother, wife, friend, and professor, I have continued to nurture and develop my commitment to ensuring that what I do benefits more than just me.”

Harvey (one of the researchers): My family has been calling Canada home since approximately 1655–1660, when my ancestors landed on Île d’Orléans in Quebec. For over three hundred years my family has kept our French-Canadian traditions alive by keeping our language and celebrating our culture. While most of my family grew up in Quebec, my roots and home are in Northern Ontario. I left home to pursue my post-secondary education and for employment opportunities. During this time, I was fortunate to work with the Mohawk, Maliseet, Anishnabee, and Cree Nations throughout Canada. In 2004, I accepted a position with Lakehead University and returned home. Through my work I now have a chance to give something back to this part of Canada (i.e., through academic work, research, and sweat equity).”

Another tactic to reduce power imbalances is to ensure communication is clear and constant. Sharing information promptly and involving participants in the decision-making process regarding project design, implementation and post-project dissemination are actions that empower participants (Safo et al., 2008). Continuous communication requires regular face-to-face conversations as well as web-based interactions (Christens & Inzeo, 2015).

Encouraging participants to learn about or feel proud of their intrinsic personal value and strengths is another way to counteract power imbalances that emerge from the assumptions members bring into the co-creative process. One reason people may feel they don’t have as much to offer during co-creative activities as other people is because “it can be difficult for many people to believe that they are creative and behave accordingly” (Sanders & Stappers, 2008, p.9). Their low self-
confidence can lead to increased uncertainty when stronger personalities emerge and dominate the power structure (Safo et al. 2016). This situation can be especially damaging to the individual if the dominant personalities have perceived privileges due to their gender, race or status (Walden et al., 2014). They may also perceive themselves as having lower decision-making power if they have limited expertise in the area being discussed and “may wonder why they are ‘at the table’ if specific connections are not made for them and if activities do not allow for the expression of their unique vantage point” (Walden et al., 2014:865). Introducing a communications structure that ensures all participants can share their perspectives is one way project leaders can demonstrate they value each individual’s voice (Sanders & Westerlund, 2011).

Finally, encourage all participants to feel empowered and ‘at the table’. One example of achieving this can be seen by the work by the Unidos Project, where leadership roles were rotated between community partners in order to give all members an opportunity to gain new leadership skills and ensure there was a sustainable sense of collective power among its large partnership network (De León et al. 2015:19). This can also be achieved by dividing resources based on the level of needs rather than equally divvying them between participants (Neal & Neal 2011). Such thoughtful division creates a sense of levelling the playing field for all members.

**Power Struggles in Co-Creation**

Power struggles tend to emerge when many personalities and personal agendas emerge during the course of the collaboration. The tensions that arise due to power struggles can, at times, be beneficial to the collaborative process. This is because conflict can lead to more creative solutions during problem-solving and, when successfully navigated, conflict has been associated with the development of positive bonds-- such as trust and respect-- and the redistribution of power within a group (Walden et al., 2014, p.856). In conducting a study to fill the gap of knowledge in literature on how power struggles can be manipulated to become catalysts for growth within collaborative settings, Walden et al. found:

“Allowing for conflict to exist and addressing it strategically will likely encourage experiences of shared power. Encouraging and practicing constructive conflict resolution strategies may create a psychological climate of safety and productivity, which provides opportunities for members to voice their opinions and dissent while moving agenda-setting forward.” (2014, p.865)

That being said, there are some power struggles that are best to avoid-- such as the strife that can emerge during collective decision-making. In their 2017 Community Engagement handbook, the North American Association for Environmental Education (NAAEE, 2017) discusses how agreeing on the decision-making process as a unity prior to beginning a project is an ideal way to preemptively avoid unnecessary power struggles. Positive strategies for collaborative decision-making include *consensus*, a process that “allows multiple, conflicting solutions to be considered simultaneously”
and “fosters creativity, cooperation, and commitment to final decisions”; straw polling, a time-saving method that asks group members to do a show-of-hands to gather opinions; and delegation, which involves divvying of decision-making to small groups with specialized knowledge/resources who will then report their decision back to the group (NAAEE, 2017:109). Majority rule is to be avoided; it is a problematic decision-making strategy for collaborative groups as it can “reinforce power imbalances, even if there are ways for the minority to make their dissenting views clear” (NAAEE, 2017, p.109).

Another good way to negate unproductive power struggles is to base the work in shared values. This follows the collective impact framework, a community organizing framework designed to bring together many partners in order to address a specific social issue (Kania & Kramer, 2011). A shared agenda acts as a compass to guide the project and re-focus attention away from individual agendas and onto the common goal (Kania & Kramer, 2011). Personally or culturally-relevant values that deeply resonate may be especially powerful in this scenario, as demonstrated by the Unidos Project:

“Respect for each other is critical and the value of always remaining in service, which is viewed as the true mark of leadership by New Mexico’s Hispanic community, is fundamental in what is communicated and reflected in all of the Unidos work. These values minimized individually-focused agendas or power grabs. The Hispanic values that were so consciously embedded in the work resonated with the individuals that gathered around the Unidos Council meeting table, the legislators that worked with the project and the individuals that were part of the strategy groups.” (De León et al., 2015, p.15)
Designing Co-Creation Spaces

Setting

Co-creation spaces should be designed to make participants feel they can safely explore, learn, discuss and debate (Reay et al. 2001; De León et al. 2015). One possible way to do this is to apply principles from *Creating Great Visitor Experiences* by Stephanie Weaver, a book on how to construct a welcoming environment (e.g. carefully designing/thoughtfully choosing entry and exit points; being mindful of bodily comforts; creating fun; engaging the five senses). There is value in ensuring there is an inviting welcome point that sets a positive starting tone in addition to a comfortable space for the co-creative actions. For example, having co-creation participants coming through a side door rather than a main entrance may be problematic, unless the side door entrance is specialized and welcoming.

Settings for co-creation should be spaces where shared values are explored and cultivated for staff and participants alike:

*Unidos Project, New Mexico, USA*

“...all meetings were held with the values of relationship and ‘familia’ at the forefront. Time was provided for greeting each other, catching-up and breaking bread together. [...] thanking people for the work they were doing went a long way to recognize the tremendous effort that was being made by everyone and to sustain that effort. Opportunities were provided for people to share their own education stories or share what kept them connected to the work of the Unidos Project.” (De León et al. 2015:15)

*Design for Health and Wellness Lab, Auckland, NZ*

“Central to this space and its ability to foster collaboration within the hospital is the DHW Lab culture. Designers, students, researchers and the DHW Lab directors have regular sessions to develop the lab culture to reinforce its core values. [...] Ultimately, these sessions helped ensure that the space reflects and enables the kind of culture necessary to promote greater interdisciplinary collaboration and innovative practice.” (Reay et al. 2001:6)

Co-creative spaces should be designed in an area that can be manipulated to easily provide a visual map of the past, current, and future design experiences (Sanders & Westerlund 2011; Reay et al. 2001).

“...the openness and temporary nature of the physical space (the furnishings and projects/prototypes in development) are used to encourage (both physically and metaphorically) ongoing experimentation and development in projects, culture and collaboration.” (Reay et al. 2001:8-9)
A wide space is also useful as co-designing often relies on large-scale visual brainstorming activities that are prominently displayed on walls, whiteboards, etc. These activity results can be left up and used as a roadmap for future meetings so that participants can remember:

1. What was previously discussed (the starting point)
2. What they are currently planning (the fluid/reactive creativity process)
3. Where they want the project to go (collective vision).

Projects that involve people from a variety of backgrounds should be sure they include materials that allow cross-understanding to occur beyond language barriers (Sanders & Westerlund 2011; Reay et al. 2001).

“To facilitate the generation and communication of ideas between team members, we had prepared toolkits that contained a wide variety of visual forms, colors and sizes. [...] By using only simple and symbolic shapes we hoped the participants could more past their own languages of expertise to focus on the shared content....” (Sanders & Westerlund 2011:3)
Museum Staff Team

Successful co-design also needs project facilitators to guide and encourage the creative process, as “to embrace co-creativity requires that one believes that all people are creative” (Sanders & Stappers 2008:9).

One reason people may resist co-creative activities is that “it can be difficult for many people to believe that they are creative and behave accordingly” (Sanders & Stappers 2008:9). However, all people demonstrate four levels of creativity during their daily lives:

- Doing (motivated by the need to be productive)
- Adapting (motivated by appropriation in order to make something their own)
- Making (motivated by the desire to assert their ability or skill)
- Creating (motivated by inspiration and meant to express creativity)

<table>
<thead>
<tr>
<th>Level</th>
<th>Type</th>
<th>Motivated by</th>
<th>Purpose</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Creating</td>
<td>Inspiration</td>
<td>‘express my creativity’</td>
<td>Dreaming up a new dish</td>
</tr>
<tr>
<td>3</td>
<td>Making</td>
<td>Asserting my ability or skill</td>
<td>‘make with my own hands’</td>
<td>Cooking with a recipe</td>
</tr>
<tr>
<td>2</td>
<td>Adapting</td>
<td>Appropriation</td>
<td>‘make things my own’</td>
<td>Embellishing a ready-made meal</td>
</tr>
<tr>
<td>1</td>
<td>Doing</td>
<td>Productivity</td>
<td>‘getting something done’</td>
<td>Organising my herbs and spices</td>
</tr>
</tbody>
</table>

(Sanders & Stappers 2008:12)

The role of a facilitator is therefore to encourage all participants in the co-design process to identify or explore their creative powers, which includes (Sanders & Stappers 2008, 14):

- Leading people who are on the ‘doing’ level
- Guiding those who are at the ‘adapting’ level
- Providing scaffolds for creative expression for those at the ‘making’ level
- Offering a clean slate for those at the ‘creating’ level

Facilitators should also plan with project leaders on how output from the visual brainstorming activities will be documented at the end of each co-design/planning session, so that the content can be permanently stored for future use, reference and/or analysis (Sanders & Westerlund 2011; Reay et al. 2001).

Communication Guidelines

There must be an agreed-upon communication system in place to ensure equal participation during the co-design process (Sanders & Westerlund 2011).
There is a sense—not implicitly stated in any co-design articles—that enforcing equal participation should NOT be part of the facilitator’s role. Having staff as the ones who are ‘keeping order’ may unintentionally build a top-down or overly controlled atmosphere. Drawing from the collective impact model—particularly the concept of building a shared agenda—may be helpful for designing an atmosphere in which everyone feels collectively responsible for (1) cultivating healthy, open dialogues and (2) giving space to quieter members of the group to speak and be heard.
Federally Funded Latinx/Indigenous Co-Creation Projects

Several federally-funded projects are currently underway or have recently been completed which focus on bringing STEM/STEAM access to Latinx and Native American youth communities. A majority of these projects have pre-set motivations and agendas which revolve around developing culturally sensitive and accessible STEM/STEAM experiences for students but not with students. Many plan to disseminate materials or models to aid future projects with underserved/rural communities.

Searching the IMLS database revealed that there were few grants to museums for STEM-specific OR Latinx-specific projects. NSF appears to have a stronger history of funding projects focused on STEM and communities of a specific heritage.

STEM Activities

- The RAIN: Rural Activation and Innovation Network project is a two-fold STEM activity design and learning research project comprised of a partnership between Community leaders from four rural regions in Arizona, the Arizona Science Center, Arizona State University, and the Center of Science and Industry. The project aims to learn 1) how locally-focused informal STEM experiences (ISE) can engage rural areas and inspire, maintain and promote a community identity based in STEM and 2) whether locally-focused ISE programs heighten awareness of, and engagement with, STEM in rural communities by establishing a participatory process sensitive to local values, cultures and interests.  
  Funder, Year: NSF AISL, 2018-2020

- Roots of Wisdom (formally titled Generations of Knowledge: Traditional Ecological Knowledge and Environmental Science) used interactive exhibits/hands-on activities to communicate and promote traditional ecological knowledge (TEK) and western science within culturally relevant contexts as valuable and complementary ways of knowing, understanding and caring for the world. The exhibit is now a travelling within the United States to share how the merging of TEK and western science can create innovative solutions to the serious environmental challenges facing our local ecosystems. Project partners were the Oregon Museum of Science and Innovation (OMSI); the Indigenous Education Institute (IEI); the National Museum of the American Indian (NMAI); the Tramastklikt Cultural Institute; the Confederated Tribes of the Umatilla Indian Reservation; the Hibub Cultural Center; and the Tulalip Tribes-operated Natural History Preserve.  
  Funder, Year: NSF AISL, 2010-2016
  [https://www.sites.si.edu/s/topic/0TO36000000L50aGAK/roots-of-wisdom-native-knowledge-shared-science](https://www.sites.si.edu/s/topic/0TO36000000L50aGAK/roots-of-wisdom-native-knowledge-shared-science)
• Arizona State University is also partnering with Utah State University and the University of Pennsylvania for *Culturally Responsive Making: Developing High-Low Tech Maker Activities in Local and Mobile Spaces for Supporting American Indian Youth*. This project aims to develop culturally responsive makerspaces for Native American youth in Arizona and Utah and, in doing so, explore making as a democratizing practice that can broaden Indigenous communities' access to and participation in STEM learning.

*Funder, Year: NSF AISL, 2016-2018*


• *MAKER: Inspiring the Flathead Indian Reservation’s Next-Generation Workforce through Mobile, Cultural Making* is a product of a long-term partnership between the spectrUM Discovery Center (part of the University of Montana at Missoula) and their partner organization, SciNation which began in 2010. Their current project will develop a mobile, cultural maker truck (the "Kwul'/I’tkin Maker Truck") that is rich with American Indian STEM role models and traditional tools and practices of the Salish, Kootenai, and Pend d'Oreille tribes. The project is designed to develop a national model for community-driven making in rural communities.

*Funder, Year: NSF EAGER, 2016-2018*


• The New York Hall of Science (NYSCI) partnered with the Queens Museum of Art to implement a program called *Queens Makes*. The program was designed to foster invention, experimental problem-solving, design and building for young tinkerers and their families in local Latino, Asian, and Caribbean communities. NYSCI also used the grant to develop an advisory board to create opportunities to cultivate relationships with makers and their networks. By providing emergent learning experiences centered on visitors’ interests, families were afforded the opportunity to explore their creative potential. The results of the project enabled makers, participants and staff to see firsthand how removing structure can spark creativity, inventiveness, and innovation.

*Funder, Year: IMLS Museums for America, 2011*


Professional Development Initiatives

- **Integrating Indigenous and Western Knowledge to Transform Learning and Discovery in the Geosciences** uses a **collective impact approach** to create new partnerships between tribal communities and STEM institutions to promote the participation and inclusion of Native American scientists in the geosciences. The project will (1) connect community-based citizen science programs for middle- and high school youth with undergraduate programs at Haskell Indian Nations University and University of Arizona and (2) connect undergrad/graduate students with summer research internships within tribal communities, tribal college faculty, traditional science institutions, and community-based citizen science organizations. Partners include Rising Voices: Collaborative Science for Climate Solutions (Rising Voices); Haskell Indian Nations University (HINU) and other member tribal colleges and communities associated with HINU; the University of Arizona’s Biosphere 2; National Center for Atmospheric Research (NCAR); NCAR’s Significant Opportunities in Atmospheric Research and Sciences program (SOARS); and Global Learning and Observation to Benefit the Environment (GLOBE) citizen science programs.
  
  *Funder, Year: NSF INCLUDES, 2016-2018*
  

- **A Study in the Integration of Western Knowledge and Native American Knowledge Bases** is a partnership between the History Colorado Center (HC), the Southern Ute Indian Tribe, Ute Mountain Ute Tribe and Ute Indian Tribe, Uintah & Ouray Reservation, and the Dominguez Archaeological Research Group (DARG). The project will investigate/integrate TEK and contemporary Western science and implement/evaluate a regional informal learning collaborative. Results will help create a model for collaboration among tribes, history museums, and scientists to increase lifelong STEM learning in rural communities.
  
  *Funder, Year: NSF AISL, 2016-2021*
  

- **Earth Partnership: Connecting STEM to Native Science** focuses on hands-on, nature-related programs such as ecological protection/restoration and citizen science projects to develop community dialogues and relationship building; informal-formal professional development collaborations; and indigenized STEM learning experiences and mentoring for students in grades 8-12. The project is operated by the Indigenous Arts & Sciences project at University of Wisconsin-Madison and convenes the expertise of elders and community members from four tribal communities (Red Cliff, Bad River, Lac du Flambeau, and Ho-Chunk Nations) in partnership with university scientists.
  
  *Funder, Year: NSF ITEST, 2016-2019*
  
Citations


