

Evolving the Museum Experience

Summative Evaluation



By

Carla Herran and Todd Shagott

OMSI Engagement Research and Advancement Division

Fall 2021

With the generous support of



This material is based upon work supported by the Institute of Museum and Library Services under grant Number MA-10-18-0388-18. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the Institute of Museum and Library Services.

Table of Contents

Executive Summary	4
Project Introduction	6
Evolving Museum Experience (EM-X) Goals and Intent	6
Purpose of this Report	8
Logic Models and Evaluation Activities	8
Project Description	9
C4I Initiative.....	9
MESA Collaboration	10
INVENT process	10
Project Logic Model.....	11
Logic model overview	11
Logic model changes	12
Design Challenges - Activities and Content	12
Design Challenge - Feeling Connected.....	13
Design Challenge - Heat Inequality.....	14
Evaluation Plans and Methods.....	18
Evaluation Plans.....	18
Methods	18
Grant Year 1 Evaluation Methods	19
Grant Year 2 Evaluation Methods	20
Grant Year 3 Evaluation Methods	21
Project Outcomes	23
Professional Strand Outcomes	23
Public Strand Outcomes	25
Implications.....	29
References	31
Appendix A - Logic Models.....	32
Appendix B - Evaluation Plans	38
Appendix C - Year 1 Instruments	53
Appendix D - Year 2 Instruments	59
Appendix E - Year 3 Instruments	65
Appendix F – Report Summaries	75

Executive Summary

With funding from the Institute of Museum and Library Services (IMLS), the Oregon Museum of Science and Industry (OMSI) strategically advanced the Center for Innovation (C4I). As both an initiative and an exhibit experience, C4I is anchored through Innovations Stations (ISs) with rotating, interactive Design Challenges (DCs). To encourage visitors to practice 21st Century Skills to address real world problems, *Evolving the Museum Experience: Human Centered Design to inspire creative community-based solutions* project (EM-X) leveraged Human Centered Design (HCD) and created design challenges. Additionally, the EM-X project was key in building staff capacity regarding HCD and collaborating with Oregon MESA, the project partner.

Through EM-X, OMSI in collaboration with MESA was able to develop and refine two Design Challenges (DC)—one for each IS. The DC content was developed as experiences that were relevant for the target audience and aligned with the United Nations' Global Goals for Sustainable Development. To this end, the design challenges put global problems in the context of participants' communities so that large-scale problems would be relatable. One of the strategies used in these activities included text co-developed in both Spanish and English, to decrease language barriers, allowing more participants to deeply engage with and understand the activities.

To inform the ISs' Design Challenge activities and assess whether the DCs achieved their intended outcomes, evaluation activities for EM-X took place during each grant year (GY). These activities included gathering feedback from MESA students and other youth and their families during GY1. For GY2 and GY3, data were gathered from MESA and OMSI program participants. Additionally, evaluation activities documented staff progress towards capacity building through the HCD approach and the collaboration with MESA.

Findings from the GY1 public evaluation suggest that the intended outcomes of the Design Challenge varied. Reports of personal relevance varied by grant year with 67% of participants of GY2 DC and over 50% of those of GY3 DC having reported the content as personally relevant. Similarly, approximately half of the GY3 participants reported that they had engaged in 21st Century Skills and practiced problem solving skills and were aware of the main messages intended by the activities.

Meanwhile, findings from evaluation of the professional development strand of the project indicate that the intended outcomes were met. Many OMSI staff reported incorporating HCD into their work. All OMSI staff reported an increased ability to identify new opportunities in which to use the HCD approach and 80% reported an interest in using HCD in future projects. Additionally, the partnership with MESA was a success with both organizations interested in maintaining and strengthening the relationship outside of the EM-X project.

The OMSI team expressed that despite the mixed outcome results, they were successfully meeting their strategic goals and will continue carrying the learnings from the EM-X project to

inform the development of design challenges that focus on local problems, while leveraging equity and addressing racial inequality issues. Additionally, OMSI intends to foster collaboration with partners and audiences that could enrich the Global Goals content of future challenges. Similarly, OMSI staff hopes to maintain and strengthen the relationship with MESA that was created during this project.

Project Introduction

The *Evolving the Museum Experience: Human-centered design to inspire creative community-based solutions* (EM-X) project started as a contribution to OMSI's strategic initiative to support the Center for Innovation (C4I) through community partnerships and deliver spaces and experiences to empower and engage youth through hands-on STEAM learning opportunities. With financial support from the Institute of Museum and Library Services (IMLS), the project has spent the past three years (2018-2021) focused on using Human Centered Design to (HCD) to create rotating design challenge experiences that are welcoming, personally relevant, and accessible to audiences who are typically underrepresented in STEAM, particularly underrepresented youth ages 9 to 14 and their families. These design challenges encourage visitors to practice and apply 21st Century Skills to address real-world problems. Additionally, the project has been key in building staff capacity and fostering collaboration with community organizations.

Evolving Museum Experience (EM-X) Goals and Intent

The EM-X project was founded with the goal of providing hands-on design challenge experiences that allow participants to practice skills related to innovation to solve key global health and development problems" known as grand challenges (Grand Challenges, 2017). These design challenges were able to stand alone as unfacilitated activities with the option for facilitation by a staff member. Initially guided by the grand challenges, then by the United Nations' Goals for Sustainable Development (UN's SDGs, also known as "Global Goals"), OMSI created the concept of the Innovation Station (IS). As an exhibit space, these ISs were developed to provide the environment, tools, and infrastructure for Design Challenges (DC)--content that was relevant, accessible, and fostered 21st Century Learning and Innovation Skills Skills (e.g., critical thinking, problem solving, collaboration, and communication) for the target audiences. Through the EM-X project, OMSI was able to create two DCs in each of the two ISs. Each DC included a suite of hands-on activities that allow visitors to explore a given problem, and build, test, and iterate solutions for the problem. Figure 1 illustrates the relationship between C4I, Global Goals, ISs, and the grand challenges.

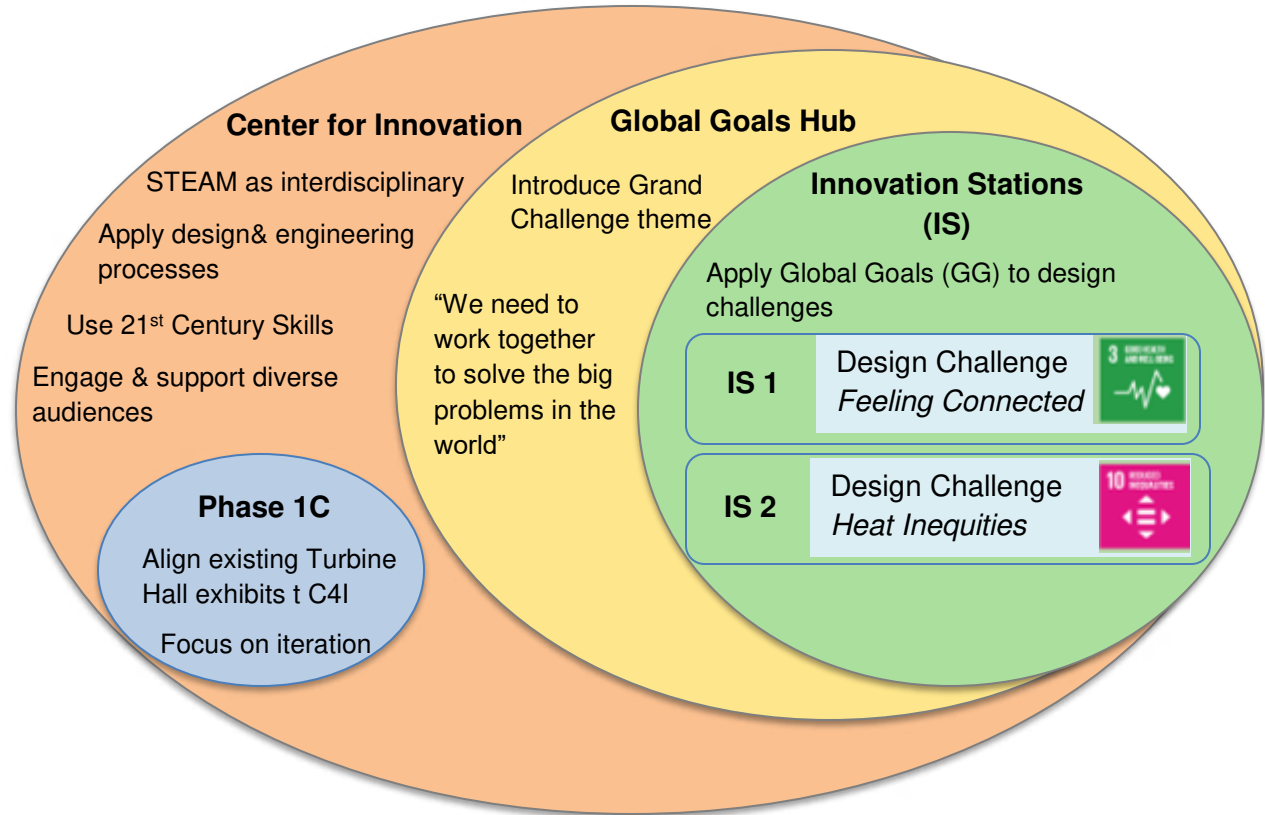


Figure 1. Center for Innovation Experience Framework

Developed with input from OMSI team members, topic and content advisors, families, students, and project and/or industry partners, these DCs were created to be both personally meaningful for visitors and aligned with the UN’s SDGs. To this end, the design challenges were designed to encourage participants to solve problems that could relate to their communities. Text co-developed in both Spanish and English was included to help decrease language barriers and allow more participants to deeply engage with and understand the activities.

To provide context and introduce visitors to the Global Goals as the overarching theme, an archway called the Global Goals Hub was built at the entrance of Turbine Hall (the area of the museum that contains the ISs). The Hub included panels intended to help visitors make high-level connections between the Global Goals and the content of each IS.

For this project, OMSI partnered with Oregon MESA (MESA)—an organization that focuses on teaching STEM, invention, and 21st Century Skills to middle and high school students historically underrepresented in STEM fields (e.g. students of color, girls, recent immigrants and refugees, impoverished populations, and first generation college students). By collaborating, OMSI and MESA created synergies that integrated MESA families, youth, and a Human Centered Design (HCD) approach into the project process and activities. This not only provided for a more informed development process, but also allowed for staff capacity building. Through this partnership, OMSI and MESA created a plan to engage MESA program participants through

evaluation activities; OMSI staff learned about the HCD process from MESA; HCD was applied to the design of museum experiences; and the team involved MESA youth throughout the process to ensure the target audience's voice was present in the content.

Purpose of this Report

The purpose of this summative evaluation report is to describe and summarize the ways and extent in which the EM-X project achieved the intended project goals and outcomes related to the public target audience (youth ages 9 to 14 and their families). Additionally, this report will discuss the goals and outcomes related to the professional target audience and the capacity building of OMSI staff through HCD and collaboration with MESA. Informed by research and recommended practices in evaluating ISE experiences (Friedman, 2008; National Research Council, 2009; U.S. Department of Education, 2007), evaluation activities incorporated both quantitative and qualitative methodologies aligned with study purposes and questions (Greene, 2007; Morgan, 2013).

Logic Models and Evaluation Activities

The EM-X project included a plan to evaluate activities and gather data to inform the iterative development and refinement of two DCs. The project team used a logic model as one of the guiding documents to record and visualize the relationships between the project deliverables, strategies, measurable outcomes, and methods. The logic model was updated annually (See Appendices A.1, A.2, A.3) to incorporate lessons learned and new information—including how to navigate the context of the COVID-19 pandemic, which started about halfway through the grant period.

Evaluation activities were adapted to reflect appropriate health safety protocols mandated by the state and the museum as a result of COVID-19. For the public strand, activities usually included post-use questionnaires and surveys. For the professional strand, MESA partners engaged in group interviews and discussions on four occasions (one interview in GY1, one interview in GY2, and two interviews or session in GY3) and OMSI project staff engaged in group interviews and discussions on two occasions through the grant period.

This document will provide information about both the professional and public strands of this project. The sections of this evaluation report are:

- Project description including descriptions of C4I, the MESA partnership, project logic models, and Innovation Station strategies
- Evaluation plans and methods
- Evaluation outcomes for the professional and public strands
- Implications for future collaborations and design challenges

Project Description

This section describes the project partnership and approaches used to achieve the EM-X public and professional intended outcomes. OMSI staff operated under the Center for Innovation (C4I) as the broader project in which EM-X was nested and partnerships and activities aligned to the main goals of experiences expected in C4I. Partners varied in their role and degree of engagement with the project, however, MESA was the main partner for EM-X. The collaboration with MESA supported OMSI staff capacity building with the INVENT process—an HCD approach that was leveraged through the project phases and development of DCs.

C4I Initiative

The idea to redevelop OMSI's Turbine Hall to include design challenges emerged during OMSI's 2014 strategic planning process. To carry out this idea, OMSI created the Center for Innovation (C4I)—an educational development initiative dedicated to working with the community to create an ecosystem for science learning.

Through research in informal science education and working meetings with stakeholders who represented different communities and perspectives, the C4I team realized that the museum needed to better integrate into the STEAM-learning ecosystem. Through this process it was decided that the redevelopment should allow visitors to engage in real-world problem solving to enhance learning, understanding, and persistence (NSF, 2016; Burns, 2011), while addressing the need of youth to develop 21st Century Skills.

Part of C4I's Master Plan was to develop flexible exhibit platforms called Innovation Stations (ISs)—spaces that provide hands-on learning experiences designed to allow visitors to solve real world challenges as seen in the C4I Experience Framework (Figure 1).

Two ISs were built during the first three months of the first Grant Year (GY). As mentioned earlier, each IS was designed to house a Design Challenge (DC) that was created to allow visitors to explore and create solutions to a given problem. The interactive design challenge exhibit component is the anchor experience in a DC. This suite of experiences, in combination with the physical design of the Innovation Station space, was planned to encourage visitors to spend time engaging with the exhibits and each other.

Corresponding with the IMLS funding, between January 2019 and July 2021, OMSI created two DCs [See Table 1 for a brief development timeline].

Table 1. Design Challenges timeline.

	GY1 & 2: Design Challenge 1	GY3: Design Challenge 2
	<i>Feeling Connected</i>	<i>Heat Inequalities</i>
Discovery	January to September 2019	October 2020 to June 2021
Installation	November 2019	July 2021
Label Update	May 2020 to February 2021	—

MESA collaboration

To create clearer, more meaningful paths through the Oregon STEAM-learning ecosystem for youth and families, OMSI partnered with Oregon MESA. By utilizing both MESA’s INVENT process and OMSI’s experience creating design challenges, the collaborative group developed hands-on design challenges that fostered 21st Century Skills and tested solutions to real world problems.

INVENT process

The INVENT process contains an implementation of many of the elements frequently seen in other design process models (Ask, Imagine, Design, Test, and Repeat), but it also incorporates feedback from users through an approach called Human Centered Design (HCD). The INVENT process includes:

- Interviewing and empathizing
- N**aming and defining the problem
- V**isioning and inspiring ideation
- E**xperimenting and making a prototype
- eN**gaging client feedback
- T**elling the world

The goal of HCD and the basis of the INVENT model is to “design with communities, to deeply understand the people [you are] looking to serve, to dream up scores of ideas, and to create innovative new solutions rooted in people’s actual needs” (IDEO.org, 2015). HCD differs from other engineering or design processes by its foundation in empathizing with a user; the process

centers on human experiences and is key to grounding STEAM knowledge in altruism and empathy.

Project Logic Model

The EM-X team used a logic model as a tool to guide the project’s deliverables and strategies. As previously discussed, the project’s logic model was refined and updated each year. These refinements reflected changes in the project and provided focus for the deliverables for that specific grant year. While this section provides a brief overview of the components of the logic model, the primary discussion focuses on highlighting some of the changes made to the logic model to illustrate reasons for changes in project direction.

Logic model overview

The EM-X logic model was based on an outcomes approach, highlighting activities of the project and their projected results. As such, the logic model focused on project deliverables, originally with eight components. Please see Table 2 for a brief description of each of the eight components used in this project's logic model. To view a copy of the logic model used for each of the three grant years, please see Appendix A.

Table 2. A list of EM-X logic model components and a description of their purpose.

Column	Purpose
Deliverables	Deliverables for the year—each of the three years had one deliverable focused on the creation/update of a design challenge and one focused on the OMSI and MESA partnership. Year 3 also had a deliverable to update the HCD playbook.
Audience	Audience of the deliverable
Strategies	Strategies used to complete the deliverable
Impacts	Impacts of the deliverable
Outcomes	Outcomes of the deliverable
Methods	Methods used to collect data for evaluation of the project
Sample	Source of the participants and the approximate number of evaluation participants from said source
Questions	Questions to be addressed in the evaluation

Logic model changes

Because the components in logic models are relational, changes in the deliverables component from year to year necessitated the revision of elements in the other components. For example, in GY1 and GY3, one of the project deliverables was to “Develop experiences through collaborative Human Centered Design (HCD) process.” In GY2, the project team reflected on the findings from the GY1 evaluation, committing to refreshing and realigning the messaging of the design challenge created in GY1. This revision to the wording in GY2, “Update experiences through collaborative Human Centered Design (HCD) process: highlighting empathy,” reflected the changes in the deliverable from GY1 to GY2.

Some of the changes to the logic model were not a direct result of a change to a deliverable, but a decision informed by newly acquired information or updated thoughts. This can be seen between GY1 and GY3, where the wording, “Use the current global health crisis as a content vehicle and encourage diverse audiences to draw on multidisciplinary knowledge and skills to consider solutions to challenges,” was refined in GY3 to “Use Global Goal #10: Addressing inequality as a content vehicle and encouraging diverse audiences to draw on funds of knowledge and skills to consider solutions to personally relevant challenges.” This update included two wording changes, 1) “Global Goal #10” explicitly identifies one of the Global Goals, instead addressing the global health crisis as a whole and 2) replacing the word “knowledge” with “funds of knowledge” recognizes the cultural, social and historical complexities of knowledge. This change was made to provide greater detail and to reflect the team's increased awareness and dedication to equity.

The changes in the logic model demonstrate that projects are not static, and as they evolve so must the thinking and strategies of the project team. Perhaps the clearest example of this was associated with the deliverable of having a “Sustainable partnership plan to guide future collaboration between OMSI and MESA.” While this was a recurring deliverable throughout the project, yearly changes to the strategies reflect the changes in the partnership. For example, one strategy in GY1 was to “Partner with industry, government, and community partners to co-develop content.” In GY2 this strategy was updated to “Partner with community partners to engage youth feedback on activity and messages;” and in GY3 it was refined to “Establish a process for sustainable ongoing informal education efforts: sustainable ongoing partnership and co-develop with partners.” Each of these revisions tells a story about the relationship between the organizations—both how the relationship itself and the goals of the relationship changed over the course of the project.

Design Challenges - Activities and Content

While each Design Challenge (DC) is quite different from the other in content, both *Feeling Connected* and *Heat Inequality* were created to encourage visitors to apply 21st Century Skills to real-world situations.

Design Challenge - Feeling Connected

The Design Challenge (DC) *Feeling Connected* supports Global Goal #3, Good Health and Well-being, and was designed to provide visitors an opportunity to practice empathy and learn about the personal and community health benefits of social connections. This DC was originally created under the topic of healthy communities but was reimagined to better represent the Global Goal #3. During Grant Year 2, labels in *Feeling Connected* were updated to bilingual (Spanish-English) exhibit copy and signs that align with Global Goals Hub in the Turbine Hall. During this time, the project team also re-worked the messages to emphasize community, empathy, and COVID-19.

Feeling Connected uses three components focused on providing visitors with an opportunity to learn about connection:

- 1) Design a Room (Figure 2) was created in partnership with Autodesk and utilized their 3D design software, Tinkercad. A Tinkercad library was co-created by OMSI teen interns and Autodesk interns to provide room elements that allowed for a multitude of designs to encourage social connections. This component was developed to encourage visitors to use technology to imagine and design a room where their friends can hang out together.

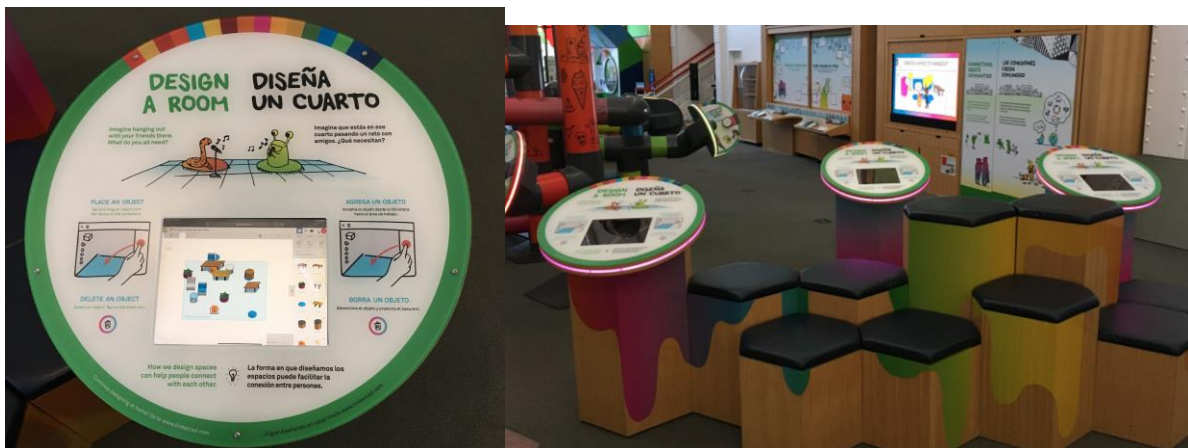


Figure 2. “Design a Room” after GY2 label testing

- 2) Boost Your Social Health (Figure 3) demonstrates difficulties in communication by providing an interactive where visitors talk to each other from different ends of a tube and hear their own voice and the voice of their partner distorted by audio effects. This encourages visitors to consider the disconnects that occur between what people say and what others hear—encouraging greater empathy and understanding when communicating with others.



Figure 3. “Boost Your Social Health” after GY2 label testing

- 3) Design with Others in Mind (Figure 4) invites visitors to design a place where a group of people can do an activity. Created to provide an opportunity for visitors to engage their imagination and practice empathizing with the needs of others, this component was co-developed with OMSI teen interns and asks visitors to consider what would be needed for a particular group of people to perform an activity. Using paper and colored pencils visitors design a space suited for the occasion.



Figure 4. Drawings from “Designs with Others in Mind” after GY2 label testing

Design Challenge - Heat Inequality

The Design Challenge *Heat Inequality* was the most recent and final activity created as part of the EM-X project and is aligned with Global Goal #10, Reduced Inequalities. This activity encourages visitors to explore and understand how planning green spaces in communities can

help to reduce racial inequalities and the disparities in urban heat. This DC was co-developed by youth as a strategy to engage the target audience in the process.

Heat Inequality was composed of four different areas or components:

- 1) **Lessen the Hot Spots** (Figure 5) is the anchor design challenge activity that allows visitors to build and test solutions for mitigating heat hazards. This component uses a lamp to shine on model homes and trees to simulate the sun heating an urban community. As visitors interact with the exhibit, an infrared camera is used to display a thermal image on a screen, allowing visitors to see where their design promoted and mitigated hotspots.



Figure 5. "Lessen the Hot Spots" component

- 2) The Heat Inequality explanatory panel and visitor responses board (Figure 6) allows visitors to compare maps of redlined neighborhoods, evening temperatures, and tree canopy cover in Portland. The panel is intended to help visitors understand that increasing heat disproportionately affects people of color and prompts visitors to reflect on the personal relevance of the main messages. To this end, visitors are presented with questions about the emotions that were evoked by the information presented and encouraged to indicate their responses to these questions using a magnetic board.

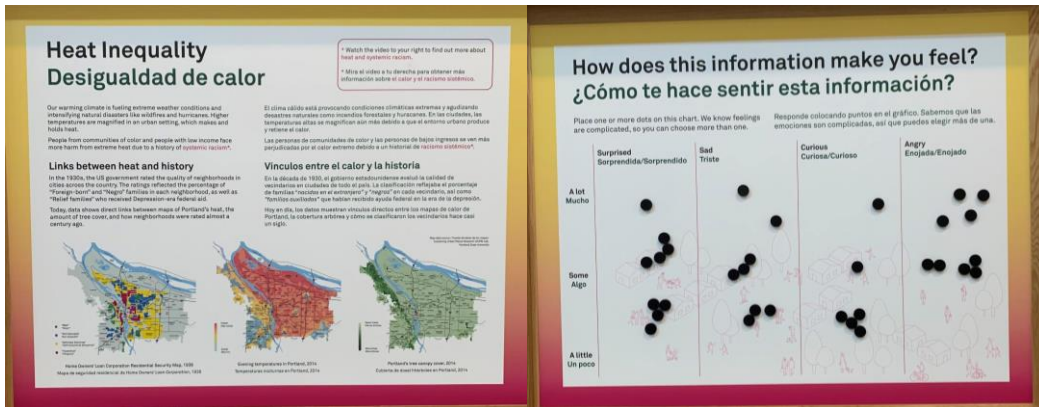


Figure 6. “Heat Inequality” explanatory panel and visitor responses board

- Inspirational Change (Figure 7) is a graphic panel that provides visitors with a local success story of how community action is helping to lessen the heat spots in some Portland neighborhoods. This informational component presents ways that heat inequities are being reduced and encourages visitors to take action in their own communities.



Figure 7. Panel at the “Inspirational Change” component

- Redlining Video (Figure 7) allows visitors to discover how historic redlining practices currently affect heat in neighborhoods. The video also shows how heat disproportionately affects people of color and low-income communities.



Figure 8. "Redlining Video" component

Evaluation Plans and Methods

This section describes the evaluation approach and methods used during the three grant years of the project. The goal of the evaluation activities was to assess the EM-X project's achievement of intended objectives and impacts and support internal use of actionable, evidence-based strategies related to project findings. Evaluation efforts were conducted internally and led by OMSI's Research and Evaluation (R&E) division.

Evaluation Plans

The evaluation for this project contained a public strand that collected data from visitors and a professional strand whose target audience included OMSI and MESA staff. For each strand, an evaluation plan was created and annually updated to address the EM-X project team's need to refine objectives while adapting to the context of the deliverables (Appendix B). Each evaluation plan outlined the year's evaluation activities, project objectives, source and number of participants, evaluation methods, analysis plan, and dissemination opportunities.

Summative evaluation activities for both professional and public strands examined the project's achievement of relevant performance goals and intended outcomes for target audiences. This included the extent to which the project was meeting two IMLS Learning Performance Goals: "Train and develop museum and library professionals," and "Develop and provide inclusive and accessible learning opportunities." This was done by studying the ways and extent in which design challenges developed through HCD elicited changes in the interest, understanding and confidence of participants.

The evaluation activities were organized around the two main deliverables of the project: 1) Innovation Stations and 2) OMSI/MESA collaboration. The specific evaluation questions, activities and methodologies for each deliverable and grant year are detailed below.

Methods

The OMSI R&E team addressed evaluation objectives using a mixed-methods approach. For the public evaluation strand, target audience included youth recruited from MESA and/or OMSI program participants or visitor groups. The methods used included observations, group interviews, and individual self-report questionnaires. Sample size, methods, and data collection time frame varied according to the project team needs and the context. Evaluation activities were conducted in the Turbine Hall at OMSI in the DC1 *Feeling Connected* area, DC2 *Heat Inequalities* area, and by Zoom video conference when necessary. For the professional evaluation strand, the target audience consisted of MESA staff, OMSI team members, and

OMSI staff who participated in the HCD training. Methods included open-ended questionnaires, group discussions, and surveys. Starting in March 2020, evaluation approaches were updated to respond to COVID-19 safety protocol and best practices mandated in the state of Oregon.

Grant Year 1 Evaluation Methods

The public summative evaluation strand for GY1 focused on DC *Feeling Connected*. Evaluation activities for this strand addressed the objectives and intended outcomes (Appendix A.1, B.1) via two strategies. The first strategy consisted of a critique approach in which MESA students provided feedback to OMSI project members in relation to the process used to create the Innovation Station; the second strategy consisted of a convenience sample of youth and their families recruited for one testing event and participants recruited from the visitor audiences (see Table 3). The methods used to collect data from these two sample groups included observations, post-use group interviews, and post-use individual self-report questionnaires. Data were collected from participants during a MESA event hosted by the museum and a four-week data collection period. Data collection took place in the Turbine Hall in the DC *Feeling Connected* area, which included the *Boost Your Social Health* exhibit, *Design a Room* exhibit, *Design with Others in Mind* exhibit, and the *Connections Create Communities* graphic panel.

The professional evaluation strand focused on two processes: 1) OMSI staff capacity building through HCD, and 2) documenting the collaboration between OMSI and MESA. Evaluation activities for this strand addressed the objectives and intended outcomes (Appendix A.1, B1) via semi-structured interviews. For the collaboration, interviews were conducted with MESA staff and OMSI EM-X core team members (see Table 3 for target and actual sample size). Information was gathered through a group debrief using a focused conversation method which uses a four-level structure of prompts (Objective, Reflective, Interpretative, Decisional). Information was gathered about the team's capacity building through the HCD by conducting interviews with OMSI EM-X core team members. This session was conducted remotely using a video meeting platform.

Table 3. GY1 sample and actual size participants

Category	Target Audience	Target Sample Size	Actual Sample
Professional strand	OMSI staff	(n=13)	4
	MESA Staff	(n=2-4)	4
Public Strand	General museum visitors	(n=20)	15
	MESA participants visiting museum	(n=20)	9

Grant Year 2 Evaluation Methods

For GY2, public evaluation activities were conducted to align with the project team members' updated objectives (Appendix A.2, B.3). This formative evaluation was conducted on DC *Feeling Connected*. Specifically, labels were revised to align with Global Goals Hub content in the Turbine Hall; the messages were revised and the signs and exhibit components were updated to provide bilingual text. The evaluation objectives were addressed using a mixed-methods approach with a convenience sample of youth recruited from MESA and OMSI Teen Science Alliance programs for three testing events (see Table 4 for target and actual sample size). Methods included observations, group interviews, and individual self-report questionnaires. Data collection was conducted during a one-week period and took place in the Turbine Hall in the DC *Feeling Connected* space. Data collection for this phase was conducted following health safety protocols mandated by the state and the museum as a result of COVID-19 and only a limited number of recruited participants, educators, and evaluators were present during the activities.

Table 4. GY2 sample and actual size participants

Category	Target Audience	Target Sample Size	Actual Sample
Professional strand	OMSI staff	(n=13)	1
	MESA Staff	(n=2-4)	4
Public Strand	TSA	(n=16)	12
	MESA participants	(n=6)	3

In Year 2 of the project, the professional evaluation strand was smaller in scope and focused on documenting the collaboration between OMSI and MESA. Evaluation activities for this strand addressed the objectives and intended outcomes (Appendix A.2, B2) via a semi structured interview with MESA staff and only one OMSI staff. The interview was conducted remotely using a video meeting platform and Google Jamboard to capture participants' responses.

Grant Year 3 Evaluation Methods

In GY3, DC2 *Heat Inequality* was completed and public summative evaluation activities addressed the objectives and intended outcomes (Appendix A.3, B.3) through a mixed-method approach. Because of the pandemic, the Turbine Hall was closed to public museum visitors, but open to small groups of OMSI summer camp students. It was from this convenience sample from OMSI summer and teen programs that children and youth were recruited for three testing events (see Table 5 for target and actual sample size). The methods used included post group discussions and post individual self-report questionnaires. Evaluation activities were conducted in a period of one week and took place in the Turbine Hall in the DC *Heat Inequality* area, which included the *Lessen the Hot Spots* exhibit, the *How does this information make you feel?* magnet wall, the *Inspirational Change* wall graphic, and the *Redlining Video*. Similar to Grant Year 2 evaluation activities, data collection for this phase was conducted following health safety protocols mandated by the state and the museum as a result of COVID-19 and only recruited participants, program educators, and evaluators were present during the activities.

Table 5. GY3 sample and actual size participants

Category	Target audience	Target Sample Size	Actual Sample
Public Strand	Summer Camps	(n=40)	36
	Teen programs	(n=13)	9
Professional strand	OMSI staff	(n=18)	10
	MESA Staff	(n=2-4)	4

In GY3 of the project, the professional evaluation strand focused on the processes of collaboration between OMSI and MESA. Evaluation activities for this strand addressed the objectives and intended outcomes (Appendix B.4) via two semi structured interviews or sessions with MESA staff. In coordination with the concurrent IMLS [MA-40-0291-19] *OMSI Empowered* (OMSI-E) project that had similar goals of evaluating OMSI partnerships, evaluation activities combined methodologies and approach. Interviews were adapted from the phenomenological approach from Irving Seidman’s *Interviewing as Qualitative Research*. The interview series consisted of two sessions. The first session focused on the past and present relationship, with questions about how the partnership was cultivated, which activities strengthened or strained the relationship, and the current state of the relationship. The second session focused on the future of the partnership, and provided the participants with a chance to share their vision and expectations regarding their connection with OMSI. The two sessions were conducted remotely using a video meeting platform and each session was scheduled 4-6 weeks apart.

Project Outcomes

This section describes and summarizes the ways and extent to which the EM-X project achieved the intended project goals and outcomes for the professional and public strands through the grant period. The evaluation goals included 1) assessing the personal relevance, accessibility and effectiveness of Design Challenges for the target public audience; 2) evaluating changes in OMSI staff knowledge and confidence around Human Centered Design; and 3) documenting the collaborative process between OMSI and MESA and its impacts on OMSI staff.

Professional Strand Outcomes

Through this strand, the OMSI evaluation team aimed to identify and track progress of the following professional outcomes:

- OMSI staff improved skills and confidence in building a sustainable, reciprocally beneficial partnership (awareness)
- OMSI staff felt confident, competent, and skilled in using HCD as a means of creating flexible, dynamic content with target audiences and partners (attitude)
- OMSI staff recognized new opportunities to utilize HCD approaches (awareness)

OMSI and MESA Collaboration

MESA staff worked with OMSI to identify how the collaboration through the project could contribute to the sustainability of the partnership beyond the grant.

During GY1, OMSI staff received positive feedback from MESA staff about the process as well as areas that could be improved. From this conversation, recommendations about how to advance the way the two organizations worked together included: sharing goals and aligning expectations when balancing different partnerships that include C4I industry partners, sharing project timeline and budgets, and starting to pursue opportunities that could strengthen the partnership beyond the grant.

During GY2, MESA staff acknowledged the challenges of adapting to remote activities due the global pandemic. Despite the challenging context, MESA staff mentioned the value of the lessons learned through the partnership and the synergies that were created through planning events and activities that were mutually beneficial. MESA participants of the evaluation mentioned their desire to continue meeting regularly to plan and support events that have been

successful as well as the need to start planning activities and developing a model for collaboration beyond the grant year.

In GY3, MESA staff mentioned that the collaboration was effective through the years because of the communication approach that included frequent check-ins and clear points of contact with OMSI staff. Throughout the interview, MESA staff emphasized that consistent, frequent, and transparent communication is vital to develop and maintain deep relationships. Respondents reported that after the grant ended, it might be challenging to maintain contact because resources will be more limited.

From the MESA interviews, recommendations that could inform the collaboration beyond the grant are:

- 1 Establish a process for working together that includes protocols and communication plans for each branch of OMSI involved (e.g. Programs team, Business and Development departments) .
- 2 Schedule regular check-ins to share updates and discuss timeline, budgets, and key documents.
- 3 Find opportunities to maintain contact with MESA after the end of the grant. This includes assigning point people at each organization to regularly have brief check-ins and setting aside time to occasionally attend or participate in MESA events.

Finally, MESA staff also expressed that partnerships evolve, transactional collaborations can be a phase between organizations, and partnerships can only be positive as long as clear goals and expectations are met.

HCD skills and awareness

Professional evaluation activities for the HCD approach were intended to document staff capacity building skills and confidence and to identify future opportunities to apply the HCD approach.

During the first year of the project, OMSI staff found the HCD-INVENT process useful for articulating the deliverables for GY1, specifically, the Design Challenge. Different levels of familiarity with the HCD approach influenced participants' levels of understanding and confidence using HCD to create content with partners after the training provided by MESA when the project was launched. Project participants reported interest in using parts of the INVENT process in the future—specifically, *Interviewing and empathizing* (I)—and diving deeper into steps such as *Visioning and inspiring ideation*(V) and *Experimenting and making a prototype* (E).

During the third and last year, the majority of OMSI staff who responded to the survey stated they had used the steps in the INVENT process. Seventy-five percent of the respondents mentioned they had very strong or fairly strong interest in using HCD outside of the project. Similarly, 75% of respondents reported that they felt comfortable identifying opportunities for the HCD approach. Participants mentioned that future opportunities for using HCD include engaging specific audiences, collaborating with youth or partners, and improving their practice. These findings suggest that through the grant years staff have developed interest, built capacity using and seeking opportunities to use the HCD process broadly and across museum initiatives or projects.

Public Strand Outcomes

The goal of the public strand was to evaluate the extent to which the Design Challenges fostered 21st Century Skills and provided content that was personally relevant. This strand informed the iterative development and refinement of the two Design Challenges during the grant years.

Through this strand, the OMSI evaluation team aimed to identify and track progress of the following outcomes for the public. Specifically, public audiences would:

- Demonstrate 21st Century Learning and Innovation Skills (skills)
- Report a sense of self-efficacy regarding their ability to problem solve, innovate, and be STEAM learners (attitude)
- Identify the content and challenge as personally relevant (awareness)
- Be aware of the content or main idea (awareness)

Table 6. Public strand outcomes

	GY1 & 2: Design Challenge 1 Feeling Connected	GY3: Design Challenge 2 Heat Inequalities
21st Century Learning and Innovation Skills: <ul style="list-style-type: none"> • Critical thinking and problem solving • Creativity and innovation • Communication and collaboration 	Almost all the observed participants exhibited behaviors related to 21st Century Skills (GY1). Observations did not provide evidence of behaviors related to expected outcomes (GY2). 47% of the participants strongly agreed or agreed that as a result of their visit, they learned something about communicating with people and considering other perspectives (GY1 and GY2). 79% of the participants strongly agreed or agreed that the activities encouraged them to be creative (GY1).	59% of the participants strongly agreed or agreed that the activities allowed the opportunity to collaborate with others. 55% of the participants strongly agreed or agreed that the activities gave them the chance to share ideas with others. 60% of the participants strongly agreed or agreed that the activities gave them the chance to try out a design solution. 59% of the participants strongly agreed or agreed that the activities encouraged them to understand social problems.
Self efficacy and problem solving:	26% of the participants strongly agreed or agreed that the activities gave them new ideas	42% of the participants strongly agreed or agreed that as a result of their visit, they felt

<p>Problem solve through empathy and/or try multiple solutions</p>	<p>on how to strengthen relationships within their communities (GY1).</p> <p>10% of the participants strongly agreed or agreed that as a result of their visit, they increased their understanding of how social connections affect people’s health (GY1).</p> <p>66% of the participants strongly agreed that the activities encouraged them to understand other people’s needs (GY2).</p> <p>40% of the participants strongly agreed that the activities increased their confidence in their ability to communicate with other people. (GY2).</p>	<p>more confident in their ability to use the information to solve the problem.</p> <p>53% of the participants strongly agreed or agreed that as a result of their visit, they felt more confident in their ability to try solutions to the heat problem.</p>
<p>Personal Relevance: Activities are relevant and/or participants can relate them to their life.</p>	<p>26% of the participants strongly agreed or agreed that the activities related to their life.(GY1).</p> <p>67% of the participants strongly agreed or agreed that the activities related to their life.(GY2).</p>	<p>52% of the participants’ strongly agreed or agreed that the content provided related to their life.</p>
<p>Content Awareness: Awareness of the topic or big idea [awareness of the Global Goal content when pertinent]</p>	<p>In GY1 participants referred to concrete activities that related to the exhibit components such as communication or building and designing.</p> <p>In GY2 participants mentioned the content and big idea as considering other people’s needs and empathy.</p>	<p>For DC2, the responses varied from elements of the activities to content of the design challenge. Participants mentioned: trees and houses, magnets on the wall, heat and shade, green spaces and impacts on people of color.</p> <p>73% of the participants strongly agreed or agreed that as a result of their visit, they increased their understanding of how heat affects different neighborhoods.</p>

Regarding public outcomes, it is important to note that unlike GY1 and GY3, evaluation activities for GY2 consisted of formative evaluation with the primary goal of evaluating the labels. It is also important to note that starting in GY2, recruited youth acted as a proxy for the target audience which was originally general public youth and their group/family visiting the museum. Despite these differences in target audience and methods, outcomes in some instances were comparable across the project years.

Demonstrating 21st Century Learning and Innovation Skills

Outcomes for the 21st Century Learning and Innovation Skills were updated each year of the project (see logic models in Appendix A) so they aligned better with the project team’s current thinking and the DC strategies and content. According to survey responses, about half (and more than half for some specific skills) of the participants reported an outcome related to the 21st Century Learning and Innovation Skills. Participants tended to agree that the activities

encouraged them to be creative (79%). The exhibit content allowed for three open-ended interactive activities that included manipulatives.

Usually, 21st Century Learning and Innovation Skills outcomes were best supported by the interactive, hands-on nature of the design challenge component in the Design Challenge. Participants were frequently observed or self-reported that they interacted with the hands-on exhibit components more frequently in comparison to the other activities in the DC. This was evident in that *Heat Inequality* had only one type of interactive design challenge and participants were initially drawn to it during data collection. It is important to note however, that labels at this exhibit, although lengthier than those at other exhibits, supported participants' understanding of the social problems described in the content (59% reported that the activities encouraged them to understand social problems and during group discussions this was evident for the content awareness outcome).

Self-efficacy regarding ability to problem solve through empathy

Although not directly comparable, indicators of this outcome varied for *Feeling Connected* due to the nature of the activities and strategies the OMSI team took to align the exhibit with the Global Goals and emphasize community and empathy. According to survey responses, percentages for GY1 26% of participants reported the activities gave them new ideas on how to strengthen relationships within their communities and 10% reported an increase in their understanding of how social connections affect people's health. These findings tended to be lower than GY2 (66% reported the activities encouraged them to understand other people's needs and 40% reported that the activities increase their confidence in their ability to communicate with other people).

Indicators of this outcome for *Heat Inequality* were not substantially different from the indicators for *Feeling Connected* in GY2. Forty-two percent reported that as a result of their visit, they felt more confident in their ability to use the information to solve the problem and 53% reported that as a result of their visit, they felt more confident in their ability to try solutions to the heat problem. The amount of text and readability in the copy panels might have influenced the responses regarding using information to solve problems.

Personal relevance

Indicators of this outcome suggest that since GY2, *Feeling Connected* activities and contents were perceived as relevant or that participants could relate to them. Participants reported that the activities relate to their life (67% GY2 and 52% GY3). The updated copy in *Feeling Connected* and the focus of content in *Heat Inequality* might have influenced the responses. Participants referred to the importance of communication during COVID times in GY2 at *Feeling Connected* while GY3 participants at *Heat Inequality* mentioned that they could relate to the issue of heat and how their neighborhoods were affected by the existence or lack of tree canopy.

Content Awareness

Participants consistently referenced the Design Challenge activities or elements of these activities as key to their engagement and as the topic or main idea of *Feeling Connected*. This was slightly less evident for participants at *Heat Inequality*. Responses about the content and big idea at *Heat Inequality* varied by age group and seemed to be influenced by the copy and labels that focused the topic in the city of Portland. It is important to note that participants at *Heat Inequality* reported an increase in their understanding of the topic as a result of their visit (73%).

Although outcomes varied by DC and the project years, it is important to note that the project team carried the learnings through each year. Results from the outcomes presented are not conclusive and might be limited by the small sample size and that the target audience was updated and did not include caregivers who could support scaffolding the experience for children and youth.

Implications

EM-X was a step in the strategic planning for the C4I that supported the OMSI mission by creating experiences that encourage youth and families to explore multidisciplinary STEAM topics, practice 21st Century Skills, and apply their knowledge and skills to real-world problems. The findings of this report will inform IS development in the future—including Design Challenges and collaboration with partners for content development.

Design Challenges

Through the EM-X project, the OMSI team realized that creating a Design Challenge (DC) through a process layered with HCD and partners' input takes more commitment of effort and time than originally scheduled. Findings from this project have already been used to inform and support the project documentation and deliverables. The project team felt that despite the challenges and project outcomes, they were successful in reaching strategic goals to define design challenges and approaches that contribute to visitor understanding of the context of human design and empathy.

Despite the complexities of creating DCs, they have the potential to be great platforms for exhibiting content and activities that are culturally responsive, address racial inequalities, and align with equity and inclusion efforts. The DC *Heat Inequality* was a good example of content that provides local relevance while pointing to the persistent racial inequalities of extreme heat and urban heat islands.

Since the Turbine Hall was closed due to the COVID-19 pandemic, evaluation activities were limited to program groups with a limited number of children and youth. This likely influenced evaluation results since the unit of analysis changed from youth and their families to only children or youth. As the Turbine Hall area reopens to the public, OMSI team members may benefit from gathering feedback from visitor groups regarding future content or topics about challenges that address racial inequalities and the successes of communities in the region.

Engaging youth

The EM-X project provided a platform for engaging youth through varied opportunities that could be used to inform future efforts and initiatives. The work done with teens through internships and co-development supported the team's thinking and was a beneficial part of the content development process. Teen involvement helped the team stretch capacities and leverage the collaboration with the project partner for youth recruitment. This effort is informing current co-development opportunities with youth, and also OMSI's hiring practices for youth. The strategies developed in this project could provide an opportunity for youth to contribute to OMSI's youth oriented Key Outcome Indicators (KOIs).

Sustaining partnerships

As OMSI advances the Culturally Inclusive Experiences strategic initiative, the need for more responsive approaches to co-develop experiences with partners and diverse audiences will arise. The experience gained in terms of planning and expectation alignment could help in creating and maintaining future partnerships and collaborations.

Feedback from MESA staff has already been used in OMSI's five year strategic planning. Similarly, MESA staff also collaborated with the OMSI-E evaluation strand and provided feedback to questions related to OMSI's approach to partnerships that will shape the KOIs for OMSI's "Community Integration" Goal. Future efforts to continue this partnership and engage in the co-developing process will require setting goals and museum investments of time, staff, and resources.

References

- Burns, W. D. (2011). "“But You Needed Me”: Reflections on the Premises, Purposes, Lessons Learned, and Ethos of SENCER, Part 1." *Science Education & Civic Engagement—An International Journal* 3(2), 5–12. Accessed November 20, 2016. http://seceij.net/seceij/summer11/burns_part_1_yo.html
- Friedman, A. (Ed.) (2008). Framework for evaluating impacts of informal science education projects. Accessed November 23, 2016. http://www.informalscience.org/sites/default/files/Eval_Framework
- Grand Challenges (2017). "Grand Challenges: Solving Global Health and Development Problems for Those Most in Need." Accessed November 24, 2017. <http://grandchallenges.org>
- Greene, J. C. (2007). *Mixed Methods in Social Inquiry*. Hoboken, NJ: Wiley.
- IDEO.org (2015). *The Field Guide to Human-Centered Design*. San Francisco, CA: IDEO. Accessed November 20, 2016. <http://www.designkit.org/resources/1>
- Morgan, D. L. (2013). *Integrating Qualitative and Quantitative Methods: A Pragmatic Approach*. Thousand Oaks, CA: SAGE Publications.
- NRC (National Research Council) (2009). *Learning science in informal environments: People, places, and pursuits*. Committee on Learning Science in Informal Environments, P. Bell, B. Lewenstein, A. Shouse, M. Feder, Board on Science Education, Center for Education, & Division of Behavioral and Social Sciences and Education (Eds.). Washington, DC: The National Academies Press. <http://dx.doi.org/10.17226/12190>
- NSF (National Science Foundation). "Dear Colleague Letter: Change Makers NSF 16-109." July 8, 2016. Accessed November 20, 2016. <https://www.nsf.gov/pubs/2016/nsf16109/nsf16109.jsp>
- Seidman, I. (2006). *Interviewing as qualitative research: A guide for researchers in education and the social sciences*. Teachers college press.
- U.S. Department of Education (2007). *Report of the Academic Competitiveness Council*. Jessup, MD: U.S. Department of Education.

Appendix A - Logic Models

Appendix A.1: Year 1 Logic Model

Deliverables	Audience	Method	Strategies	Impacts	Outcomes	Methods	Sample	Questions
Two Design Challenges (DCs)	Families visiting OMSI Recruited families	OMSI/MESA events • Interviews Visitor interviews Family Science Night event observation and post-use interview	<ul style="list-style-type: none"> Develop experiences through collaborative Human-centered Design (HCD) process Encourage diverse audiences to draw on multidisciplinary knowledge and skills to solve personally relevant challenges Support 21st Century Learning and Innovation Skills 	Visitors: <ul style="list-style-type: none"> See themselves as problem solvers capable of using their skills, knowledge, and experiences to address personally relevant challenges. (Attitude) Demonstrate 21st Century Learning and Innovation Skills. (Skills) Recognize the value and personal relevance of multidisciplinary learning and the design thinking processes for solving complex problems. (Awareness, Knowledge, Attitude) 	<ul style="list-style-type: none"> Visitors will demonstrate 21st Century Skills of <ul style="list-style-type: none"> Critical thinking and problem solving Communication and collaboration Visitors will report a sense of self-efficacy regarding their ability to problem solve, innovate, and be STEAM learners. 	<ul style="list-style-type: none"> Observation/Post use data 	<ul style="list-style-type: none"> OMSI visitors engaging with design challenges = 40 Recruited participants = 40 	To what extent do visitors define and complete a challenge? To what extent are visitors engaged in 21st century skills? HCD? How personally relevant and interesting are the challenges for target audiences? What are the challenges/exhibit for the participants?

<p>Sustainable partnership plan to guide future collaboration between OMSI and MESA</p>	<p>OMSI C4I and Outreach Staff MESA Staff</p>	<p>Survey and interviews: Reflective interview before end of each year. Survey</p>	<ul style="list-style-type: none"> Partner with industry, government, and community partners to co-develop content Co-develop experiences to engage audiences in employing HCD and empathy in developing their own solutions to design challenges. Establish a process for sustainable ongoing informal education efforts. 	<ul style="list-style-type: none"> Staff will feel confident, competent, and skilled in using HCD as a means of creating flexible, dynamic content with target audiences and partners. (Attitude) Staff will improve skills and confidence in building sustainable, reciprocally beneficial partnerships (Attitude and Knowledge) Staff will recognize new opportunities to utilize HCD approaches. (Awareness) 	<ul style="list-style-type: none"> Staff will feel confident, competent, and skilled in using Human-Centered Design as a means of creating flexible, dynamic content with target audiences and partners. OMSI staff will develop skills to engage audiences in employing Human-Centered Design and empathy in developing their own solutions to design challenges. Staff report improved skills and confidence in building sustainable, reciprocally beneficial partnerships Staff will report increased awareness of HCD opportunities. 	<p>Post survey and Interview: after first and second year</p>	<ul style="list-style-type: none"> OMSI CFI Staff: 26 MESA Staff: 4 	<p>To what extent is HCD used by OMSI staff? What parts/portion of HCD will staff use again? What benefits do OMSI Staff and MESA report? From the collaboration, what was effective? How do both organizations intend to maintain the collaboration model?</p>
---	--	--	---	--	--	---	---	---

Appendix A.2: Year 2 Logic Model

Deliverables	Audience	Strategies	Impacts	Outcomes	Methods	Sample	Questions
Refresh messaging of current Design Challenge: align with Global Goals and make bilingual	<p>Youth 9-14 years old:</p> <p>TSA (Teen Science Alliance, youth volunteers at OMSI)</p> <p>MESA Staff and MESA students</p>	<ul style="list-style-type: none"> Update experiences through collaborative Human-centered Design (HCD) process: highlight empathy Use the current global health crisis as a content vehicle and encourage diverse audiences to draw on multidisciplinary knowledge and skills to consider solutions to personally relevant challenges. Support 21st Century Communication and Collaboration Skills 	<p>Visitors:</p> <ul style="list-style-type: none"> See themselves as problem solvers capable of using empathy to address personally relevant challenges. (Attitude) Demonstrate 21st Century Communication and Collaboration Skills. (<i>Skills</i>) Recognize the value and personal relevance of multidisciplinary learning and the design thinking processes for solving complex problems. (Attitude) 	<ul style="list-style-type: none"> Visitors will demonstrate 21st Century Skills of Communication and Collaboration Visitors will report a sense of self-efficacy regarding their ability to problem solve: understanding and using empathy Visitors will be aware of the global goals and how it plays in current context. 	<ul style="list-style-type: none"> Post use observation Post use interview: individual responses and focus group discussion. 	<ul style="list-style-type: none"> Recruited TSA participants= 10 MESA Students participants = 10 <p>MESA staff = ~2</p>	<p>To what extent are visitors engaged with the activities?</p> <p>To what extent are visitors engaged in 21st century skills?</p> <p>To what extent are visitors engaged in HCD: demonstrate use of empathy?</p> <p>How personally relevant and interesting for target audiences?</p>

Appendix A.3: Year 3 Logic Model

Deliverables	Audience	Strategies	Impacts	Outcomes	Methods	Sample	Questions
<p>One Design Challenge - using the GG #10 (Reduced Inequalities) and extreme urban heat content in the context of the DC2.</p>	<p>Families visiting OMSI</p> <p>MESA Recruited youth and their families</p>	<ul style="list-style-type: none"> DC2 leverages new exhibit component. Develop experiences through collaborative Human-centered Design (HCD) process Use Global Goal #10: Addressing inequality as a content vehicle and encourage diverse audiences to draw on funds of knowledge and skills to consider solutions to personally relevant challenges. Teen cohort to advise and 	<p>Visitors:</p> <ul style="list-style-type: none"> See themselves as problem solvers capable of using their skills, knowledge, and experiences to address personally relevant challenges. (Attitude) Demonstrate 21st Century Learning and Innovation Skills. (Skills) Are aware of the value and personal relevance of multidisciplinary strategies for solving complex problems. (Awareness, Knowledge) 	<ul style="list-style-type: none"> Visitors will demonstrate 21st Century Skills of: <ul style="list-style-type: none"> Critical thinking and creative problem solving Communication and collaboration Visitors will report a sense of self-efficacy regarding their ability to problem solve, try multiple solutions, and be STEAM learners. Visitors will be aware of the Global Goal 10 content: Heat Inequalities Visitors will identify the content and challenge as 	<p>Event with OMSI program children and youth:</p> <p>post-use interview</p> <ul style="list-style-type: none"> Group discussion Post use interview Post use survey 	<ul style="list-style-type: none"> Recruited participants= ~50 	<p>To what extent are visitors engaged with the activities?</p> <p>To what extent do visitors define and complete a challenge?</p> <p>To what extent are visitors engaged in 21st century skills? exhibit behaviors related to parts of HCD?</p> <p>How personally relevant and interesting for target audiences?</p> <p>What are the challenges/exhibit or the participants?</p> <p>How well is problem solving embedded in the Global Goals</p>

		<p>support in the co-creation of content that encourages diverse audiences to draw on multidisciplinary knowledge and skills to solve personally relevant challenges</p> <ul style="list-style-type: none"> • Support 21st Century Learning and Innovation Skills 		personally relevant.			content and system-based narratives in design challenges?
Sustainable partnership plan to guide future collaboration between OMSI and MESA.	<p>OMSI C4I Staff</p> <p>MESA Staff</p>	<ul style="list-style-type: none"> • Establish a process for sustainable ongoing informal education efforts: sustainable ongoing partnership and co-develop with partners. 	<p>OMSI Staff:</p> <ul style="list-style-type: none"> • Be able to create sustainable, reciprocally beneficial partnerships (Attitude and Knowledge) 	<p>OMSI Staff:</p> <ul style="list-style-type: none"> • And partner will report improved skills and confidence in building sustainable, reciprocally beneficial partnerships. 	<p>Survey and interviews:</p> <p>Reflective interview before the end of each year.</p> <p>Survey collected through the project</p> <p>Post survey and Interview: after first and second year</p>	<ul style="list-style-type: none"> • OMSI CFI Staff: 8 • MESA Staff: 4 	<p>What benefits do OMSI Staff and MESA report?</p> <p>From the collaboration, what was effective?</p> <p>How do both organizations intend to maintain the collaboration model?</p>

<p>Design challenge - HCD Playbook updated.</p>	<p>MESA Staff</p>	<ul style="list-style-type: none"> Partner with government, industry, and community partners to co-develop content Recognize new opportunities to leverage Global Goal content 	<p>OMSI Staff:</p> <ul style="list-style-type: none"> Be confident, competent, and skilled in using elements of HCD as a means of co-creating content with diverse audiences and partners. (Attitude) Recognize future opportunities to utilize elements of HCD approach. (Awareness) 	<p>OMSI Staff:</p> <ul style="list-style-type: none"> Will feel confident, competent, and skilled in using Human-Centered Design as a means of creating flexible, dynamic content with target audiences and partners. Will develop skills to engage audiences in employing elements of the Human-Centered Design and empathy in developing design challenges. Will report increased awareness of HCD opportunities. 	<p>Survey and interviews:</p> <p>Reflective interview before the end of each year.</p> <p>Survey collected through the project</p>	<ul style="list-style-type: none"> OMSI CFI Staff: 8 	<p>To what extent HCD is used by OMSI staff?</p> <p>What parts/portions of HCD will staff use again?</p>
---	-------------------	---	---	---	--	---	--

Appendix B - Evaluation Plans

Appendix B.1: Year 1 Evaluation Plan

EVOLVING THE MUSEUM EXPERIENCE – EM-X: SUMMATIVE EVALUATION PLAN YEAR 1

Study Contact: Carla Herran, Research and Evaluation Associate, OMSI

PROJECT BACKGROUND

The Evolving the Museum Experience: Human-centered design to inspire creative community-based solutions (EM-X) project has the goal is to create hands-on Design Challenges that inspire diverse youth and families to use 21st Century Skills (IMLS, 2016¹) to imagine and test solutions to real-world problems. The Design Challenges allow OMSI to integrate dynamic experiences based on community input into our Center for Innovation (C4I—an exhibition hall) and Statewide Outreach strategic initiatives. To accomplish this goal, OMSI will work closely with Oregon MESA (MESA)—the local branch of a national organization that uses human-centered Design Challenges to teach STEM, invention, and 21st Century Skills to middle and high school students historically underrepresented in STEM fields. (Underrepresented students, here, are defined as students of color, girls, recent immigrants and refugees, impoverished populations, and first generation college students.) By collaborating, OMSI and MESA will be able to create clearer, more meaningful paths through the Oregon STEAM-learning ecosystem for youth and families.

Proposed evaluation activities are comprehensive and will span the entire project, focusing on the iterative development and refinement of the two EM-X Design Challenges. Summative evaluation activities will examine the project’s achievement of relevant performance goals and intended impacts on target audiences. The evaluation will assess the extent to which the project is meeting two IMLS Learning Performance Goals: “Train and develop museum and library professionals” and “Develop and provide inclusive and accessible learning opportunities.”

The evaluation will be organized around the two main deliverables of the project: 1) Design Challenges and 3) OMSI/MESA collaboration

Target Audience

Public audiences – (a) families with children/youth ages 9-14 who visit OMSI, representing various racial/ethnic backgrounds, various socioeconomic statuses, and with varying abilities (physical, emotional, and cognitive).

Professional audience – (a) OMSI staff, specifically staff engaged in the development and implementation of the design project and (b) MESA staff who engaged and collaborated with OMSI staff through the project.

¹ References cited in the narrative are listed in Supportingdoc1 as part of the Evaluation Plan.

EVALUATION ACTIVITIES, ANALYSES, & REPORTING

Public Strand

The primary goal of the public education strand is to encourage program participants to practice 21st Century Skills, or the “skills and knowledge students need to succeed in work, life and citizenship, as well as the support systems necessary for 21st century learning outcomes” (P21CS, n.d). Specifically, the project intends to support participants’ practice of Learning and Innovation Skills (the 4Cs) within the context of human design center. These 21st Century skills include:

- Communication and collaboration
- Creativity and innovation

Evaluation Questions

In collaboration with the cross-departmental Evolving the Museum Experience team, the project’s internal evaluator will develop summative evaluation questions. These questions will serve as a framework for the study and will help guide subsequent instrument development.

These questions are as follows:

To what extent do participants complete an activity?

How personally relevant is an activity for participants? (How participants relate to the activities?)

What is the exhibit about for participants? (surprises?)

What learning and innovation skills are participants engaging in and to what extent?

Sample Size

Through the summative study, the evaluation team will capture observations and interviews from general visitor families. For a specific event planned during a family Science Night in collaboration with our project partner MESA, the evaluation team will also gather information through a critique approach in which MESA students will act as experts and will interview project staff regarding the exhibit bay created using the INVENT process. This process will allow project to reflect on the process and the final product: Design Challenge.

Table 1. Target Audiences & Interview Sample Sizes

YEAR	Category	Event Name	Target Sample Size	Total Sample
1	Design Challenge 1	GA visitor	(n=20)	40
	Design Challenge 1	Specific event: MESA Family Night	(n=20)	

Analysis & Reporting

Measurement of participants' practice of 21st Century Skills, self-efficacy, confidence and identity will be documented via naturalistic observations and post-use interview. OMSI's research and evaluation staff will observe and document participants' use of 21st Century Skills and administer a post-use survey.

Observation protocols will explore the extent to which participants are engaged in 21st century learning skills and aspects of HCD. Following their interaction with the challenges, visitor groups will be asked to complete a short survey that asks about interest in, understanding of and relevance of the design challenge topics as well as demographic information.

In addition, during the Family Night event, evaluation staff will observe MESA students interview OMSI staff related to Exhibit bay process and content. Once this process has concluded, evaluation staff will interview MESA students who participated on this process with the goal of gathering their reflections on the overall process, assessment of the INVENT process, and the affordance of 21st skills on the exhibit bay.

OMSI's research and evaluation staff will enter observational and questionnaire data, collected via paper instruments, into an online survey system immediately after each observed program offering. Preliminary analyses of resulting program-specific data will be shared with the project team, while additional analyses will be conducted near the end of the project to identify broader project and participation trends.

Professional Strand

The goal of the professional strand is to evaluate the collaborative model of OMSI and MESA and how the process used contributes to the collaboration model.

This strand of the project aims to build institutional capacity by increasing staff's skills and confidence incorporating HDC as mean to create content with target audiences and partners and by strengthening and informing OMSI collaboration models.

Evaluation Questions

For OMSI staff:

What parts/steps/portions of HCD are particularly useful? Why?

What parts/steps/portions of HCD will they use again?

For OMSI and MESA Staff:

What benefits from the collaboration partnership do staff from each institution report?

What is the shared learning?

What is particularly effective?

Looking at the next year, what do you hope to accomplish together?

Sample Size

Table 2. Target Interview & Survey Sample Sizes

Year	Target Audience	Data collection method	Target Sample Size	Total Sample
1	OMSI Staff	Survey Interview	(n=10) (n=3)	16

1	MESA staff	Interview	N=~2-4	4
---	------------	-----------	--------	---

Analysis & Reporting

The EM-X evaluation team will assess and measure the project’s achievement of the goals through the use of two data collection methods: online surveys and semi-structured interviews. Survey questions will explore knowledge, interest, and opportunities regarding HCD. Interview questions will explore perspectives on the project and processes, identification of successes and challenges, and perceived benefit and costs of the collaboration. Data collected will be cleaned, coded and entered into a digital database for analysis. An evaluation report prepared by R&E will summarize the impacts on staff of participating in the project, as well as reflections on how successfully the collaboration functioned and how sustainable the collaboration may be going forward.

DISSEMINATION

Evaluation findings will be distributed and presented to the project team to inform implementation and cross-departmental activities throughout the project. This report will include some of the insights and reflections from the MESA collaboration after the Year 1.

Appendix B.2: Year 2 Professional Evaluation Plan

EVOLVING THE MUSEUM EXPERIENCE – EM-X: SUMMATIVE EVALUATION PLAN YEAR 2

Study Contact: Carla Herran, Research and Evaluation Associate, OMSI

PROJECT BACKGROUND

The Oregon Museum of Science and Industry's (OMSI) *Evolving the Museum Experience: Human-Centered Design to Inspire Creative Community-Based Solutions (EM-X)* project, funded in part by an Institute of Museum and Library Services (IMLS) Learning Experiences grant, explored the creation of content while building staff capacity and engaging in partnerships. The project goal is to create hands-on Design Challenges that inspire diverse youth and families to use 21st Century Skills (IMLS, 2016) to imagine and test solutions to real-world problems. The Design Challenges allow OMSI to integrate dynamic experiences based on community input into our Center for Innovation (C4I—an exhibition hall) and Statewide Outreach strategic initiatives. To accomplish this goal, OMSI will work closely with Oregon MESA (Mathematics Engineering Science Achievement)—the local branch of a national organization that uses human-centered Design Challenges to teach STEM, invention, and 21st century skills to middle and high school students historically underrepresented in STEM fields. Here, underrepresented students are defined as students of color, girls, recent immigrants and refugees, impoverished populations, and first generation college students. By collaborating, OMSI and MESA will be able to create clearer, more meaningful paths through the Oregon STEM-learning ecosystem for youth and families.

The professional evaluation strand has two goals: (1) evaluate the collaborative model of OMSI and MESA and how the process used contributes to the collaboration model, and (2) evaluate how the use of Human-Centered Design (HCD) supported building teams' capacity.

Target Audience

Professional audience – (a) OMSI staff, specifically staff engaged in the development and implementation of the design project and (b) MESA staff who engaged and collaborated with OMSI staff through the project.

EVALUATION ACTIVITIES, ANALYSES, & REPORTING

Project Impacts: Professional Strand

Evaluation activities outlined in this plan pertain to the project's professional impact strand. Through this strand, OMSI aims to identify and track progress of the following professional impacts:

- Attitude and knowledge: OMSI staff will improve skills and confidence in building sustainable, reciprocally beneficial partnerships.
- Attitude: OMSI staff will feel confident, competent, and skilled in using HCD as a means of creating flexible, dynamic content with target audiences and partners.
- Awareness: OMSI staff will recognize new opportunities to utilize HCD approaches.
- Awareness: MESA and OMSI staff will gain awareness regarding the collaboration process: benefits, challenges, and learnings.

Professional Strand

The goal of the professional strand is to evaluate the collaborative model of OMSI and MESA and how the process used contributes to the collaboration model.

This strand of the project aims to build institutional capacity by increasing staff's skills and confidence incorporating HCD as a means to create content with target audiences and partners and by strengthening and informing OMSI collaboration models.

Evaluation Questions

For OMSI staff:

- What parts/steps/portions of HCD are particularly useful? Why?
- What parts/steps/portions of HCD will they use again?

For OMSI and MESA Staff:

- What benefits from the collaboration partnership do staff from each institution report?
- What is the shared learning?
- What is particularly effective?
- Looking at the next year, what do you hope to accomplish together?

Sample Size

This strand of the summative evaluation Year 2 will explore how project efforts build capacity using HCD and the collaboration model between OMSI and MESA. These participants included:

1. Cross-departmental OMSI staff who participated as core team members of the project
2. Representatives of MESA

Table 1. Target Interview & Survey Sample Sizes

Year	Category	Data collection method	Target Sample Size	Purpose
2	OMSI Staff	Survey by email	(n= ~6)	Examine staff confidence and use of HCD
2	MESA staff	Interview	n=~2-4	Examine collaboration process and contributions to the collaboration model

Analysis & Reporting

The EM-X evaluation team will assess and measure the project's achievement of the goals through the use of two data collection methods: **online survey** and **semi-structured interviews**. Survey questions will explore knowledge, interest, and opportunities regarding HCD with OMSI staff. Interview questions will explore perspectives on the project and processes, identification of successes and challenges, and perceived benefit and costs of the collaboration

with MESA staff and one OMSI project staff. Data collected will be cleaned, coded and entered into a digital database for analysis. An evaluation report prepared by R&E will summarize the impacts on OMSI staff participating in the project, as well as reflections on how successfully the collaboration functioned and how sustainable the collaboration may be, going forward.

DISSEMINATION

Evaluation findings will be distributed and presented to the project team to inform implementation and cross-departmental activities throughout the project. A brief report will be developed. This report will include some of the insights and reflections from the MESA collaboration after the Year GY2.

Appendix B.3: Year 2 Public Evaluation Plan

EVOLVING THE MUSEUM EXPERIENCE –EM-X: FORMATIVE EVALUATION PLAN

v.7.20.20

PROJECT BACKGROUND

The *Evolving the Museum Experience: Human-centered design to inspire creative community-based solutions (EM-X)* project has the goal to create hands-on design challenges that inspire diverse youth and families to use 21st Century Skills (IMLS, 2016²) to imagine and test solutions to real-world problems. These design challenges integrate dynamic experiences based on community input into OMSI's Center for Innovation (C4I—an exhibition hall) and Statewide Outreach strategic initiatives. To accomplish this goal, OMSI is working closely with Oregon MESA (MESA)—the local branch of a national organization that uses human-centered design challenges to teach STEM, invention, and 21st Century Skills to middle and high school students historically underrepresented in STEM fields. Here, underrepresented students are defined as students of color, girls, recent immigrants and refugees, impoverished populations, and first generation college students. By collaborating, OMSI and MESA will be able to create clearer, more meaningful paths through the Oregon STEAM-learning ecosystem for youth and families.

Project evaluation activities focus on the iterative development and refinement of the two *EM-X* design challenges. Summative evaluation activities will assess the extent to which the project is meeting two IMLS Learning Performance Goals: “Train and develop museum and library professionals” and “Develop and provide inclusive and accessible learning opportunities.” The evaluation for GY2 will be organized around one main deliverable of the project: Innovation Station 1

Target Audience

Public audiences – (a) families with children/youth ages 9-14 who visit OMSI, representing various racial/ethnic backgrounds, various socioeconomic statuses, and with varying abilities (physical, emotional, and cognitive).

EVALUATION ACTIVITIES, ANALYSES, & REPORTING

Public Education Strand

The primary goal of the public education strand is to encourage program participants to practice 21st Century Skills, or the “skills and knowledge students need to succeed in work, life and citizenship, as well as the support systems necessary for 21st century learning outcomes” (P21CS, n.d). Specifically, the project intends to support participants’ practice of Learning and Innovation Skills (the 4Cs) within the context of human-centered design (cite). These 21st Century skills including communication and collaboration.

Overarching Evaluation Questions

² References cited in the narrative are listed in Supportingdoc1 as part of the Evaluation Plan.

The cross-departmental *Evolving the Museum Experience* team, including the project’s internal evaluator, developed formative evaluation questions. These questions served as a framework for the study and helped guide subsequent instrument development. These questions are as follows:

- To what extent are participants engaged with the activities?
- How personally relevant is an activity for participants? How do participants relate to the activities?
- In what ways is the messaging effective?
- What is the exhibit about for participants? Any surprises for the team?
- What learning and innovation skills are participants engaging in and to what extent? What evidence is generated for HCD Empathy and the 21st Century Skills of collaboration and communication?

Sample Size

Through the formative evaluation, the team captured observations and interviews from recruited youth audiences. Given that the museum is closed due to the COVID-19 pandemic, limited attendance is allowed and strict safety protocols are in place, the project team proposed to recruit youth to participate in the formative study for Grant Year 2. Youth who are part of OMSI’s Teen Science Alliance (TSA) will participate in two events to test the activities. TSA is a program that engages youth ages 12-17. In addition, MESA youth also participated in a testing activity.

Table 1. Recruitment Sample Sizes

YEAR	Category	Event Name	Target Sample Size	Total Sample
2	Exhibit bay 1	TSA	day 1 (n = 6) day 2 (n=10)	20
	Exhibit bay 1	MESA specific recruitment event	(n=6)	

Analysis & Reporting

Measurement of participants’ practice of 21st Century Skills, self-efficacy and confidence were documented via **naturalistic observations** and **post-use questionnaires** followed by a **group discussion**. OMSI’s research and evaluation staff observed the recruited Teen Science Alliance (TSA) and MESA participants’ use of 21st Century Skills and the HCD Empathy Process and administer a post-use survey. Following their interaction with the Innovation Station, participants will be asked to complete a short survey that asks about their interest in, their understanding of, and the relevance of the content and the activity to them, as well as demographic information. Participants will be invited to break into pairs to share their responses with another person. This will be followed by a group discussion and will be facilitated by a project team member.

OMSI’s research and evaluation staff will enter the observation and questionnaire data, collected via paper instruments, into an online survey system immediately after each session with the TSA and MESA youth.

Formative Evaluation Focus and Questions

The focus of the formative phase is to evaluate how effectively the experience communicates the main message. The main message is: Connecting with people improves mental and physical health. It is important to design solutions for connecting with people by considering other people's needs.

Indicators of learning as mentioned by the team:

- Visitors read and are guided by the labels
- Visitors use empathy to understand other people's needs
- Visitors try an idea, learn from it and try again
- Visitors' designs (including spoken ideas at the Communication Breakdown Exhibit Bay) are in response to specific ideas or needs

Appendix B.4: Year 3 Professional Evaluation Plan

PROJECT BACKGROUND

The Oregon Museum of Science and Industry's (OMSI) *Evolving the Museum Experience: Human-Centered Design to Inspire Creative Community-Based Solutions (EM-X)* project, funded in part by an Institute of Museum and Library Services (IMLS) Learning Experiences grant, explored the creation of content while building staff capacity and engaging in partnerships. The project goal is to create hands-on Design Challenges that inspire diverse youth and families to use 21st century skills (IMLS, 2016) to imagine and test solutions to real-world problems. The Design Challenges allow OSI to integrate dynamic experiences based on community input into our Center for Innovation (C4I—an exhibition hall) and Statewide Outreach strategic initiatives. To accomplish this goal, OSI will work closely with Oregon MESA (Mathematics Engineering Science Achievement)—the local branch of a national organization that uses human-centered Design Challenges to teach STEM, invention, and 21st century skills to middle and high school students historically underrepresented in STEM fields. Here, underrepresented students are defined as students of color, girls, recent immigrants and refugees, impoverished populations, and first generation college students. By collaborating, OSI and MESA will be able to create clearer, more meaningful paths through the Oregon STEM-learning ecosystem for youth and families.

The professional evaluation strand has two goals: (1) evaluate the collaborative model of OSI and MESA and how the process used contributes to the collaboration model, and (2) evaluate how Human-Centered Design (HCD) supported building teams' capacity.

Target Audience

1. **Professional audience** – (a) OSI staff, specifically staff engaged in the development and implementation of the design project and (b) MESA staff who engaged and collaborated with OSI staff through the project.

EVALUATION ACTIVITIES, ANALYSES, & REPORTING

Project Impacts: Professional Strand

Evaluation activities outlined in this plan pertain to the project's professional impact strand. Through this strand, OSI aims to identify and track progress of the following professional impacts:

- Attitude: OSI staff are confident, competent, and skilled in using elements of HCD as a means of co-creating content with diverse audiences and partners
- Awareness: OSI staff recognize future opportunities to utilize elements of HCD approach

- Attitude and Knowledge: OMSI Staff are able to create sustainable, reciprocally beneficial partnerships

Professional Strand

The goal of the professional strand is to evaluate the collaborative model of OMSI and MESA and how the process used contributes to the collaboration model. In coordination with the OMSI-E Evaluation strand that is exploring OMSI partnerships, the approach and methods will be negotiated to create synergies that allow both projects to meet their goals.

This strand of the EM-X project aims to build institutional capacity by increasing staff's skills and confidence incorporating HDC as a means to create content with target audiences and partners and by strengthening and informing OMSI collaboration models.

Appendix B.5: Year 3 Public Evaluation Plan

EVOLVING THE MUSEUM EXPERIENCE – EM-X SUMMATIVE EVALUATION PLAN

v.7.23..21

PROJECT BACKGROUND

The *Evolving the Museum Experience: Human-centered design to inspire creative community-based solutions (EM-X)* project has the goal to create hands-on Design Challenges that inspire diverse youth and families to use 21st Century Skills (IMLS, 2016) to imagine and test solutions to real-world problems. The Design Challenges allow OMSI to integrate dynamic experiences based on community input into our Center for Innovation (C4I) and Statewide Outreach strategic initiatives. To accomplish this goal, OMSI will work closely with Oregon MESA (MESA)—the local branch of a national organization that uses human-centered Design Challenges to teach STEM, invention, and 21st Century Skills to middle and high school students from populations who have historically been underrepresented in STEM fields. For the purpose of this report, the term underrepresented students refers to students of color, girls, recent immigrants and refugees, impoverished populations, and first generation college students. By collaborating, OMSI and MESA will be able to create clearer, more meaningful paths through the Oregon STEAM-learning ecosystem for youth and families.

Summative evaluation activities will examine the project’s achievement of relevant performance goals and intended impacts on target audiences. The evaluation will assess the extent to which the project is meeting two IMLS Learning Performance Goals: “Train and develop museum and library professionals” and “Develop and provide inclusive and accessible learning opportunities.”

The evaluation for GY3 will be organized around one main deliverable of the project: Design Challenge (DC2) *Heat Inequality*. Design Challenge in this case is a suite of exhibit components, activities, and panels organized around a topic and content that supports that topic.

Target Audience

Public audiences – children/youth ages 9-14 who will be recruited from various OMSI programs. This audience ideally will represent various racial/ethnic backgrounds, various socioeconomic statuses, and with varying abilities (physical, emotional, and cognitive).

EVALUATION ACTIVITIES, ANALYSES, & REPORTING

Public Education Strand

The primary goal of the public education strand is to encourage program participants to practice 21st Century Skills, or the “skills and knowledge students need to succeed in work, life and citizenship, as well as the support systems necessary for 21st century learning outcomes” (P21CS, n.d). Specifically, the project intends to support participants’ practice of Learning and Innovation Skills (the 4Cs) within the context of human-centered design. These 21st Century skills include critical thinking and creative problem solving and communication and collaboration.

Overarching Evaluation Questions

In collaboration with the cross-departmental E-MX team, the project’s internal evaluator will develop summative evaluation questions. These questions will serve as a framework for the study and will help guide subsequent instrument development. These questions are as follows:

- To what extent are participants engaged with the activities?
- To what extent do visitors define and complete a challenge?
- How personally relevant is an activity for participants?
- What is the exhibit about for participants? (surprises?)
- What learning and innovation skills are participants engaging in and to what extent? (consider HCD Empathy, 21st Century Skills: critical thinking and creative problem solving and communication and collaboration)
- How well is problem solving embedded in the Global Goals content and narratives in design challenges?

Sample Size

Through the summative study, the team will capture group and individual responses from recruited children/youth audiences. Considering the COVID-19 context in which the museum limited attendance is allowed, and strict safety protocols are placed, the project team will recruit children and youth who are part of the OMSI summer programs -- summer camps and classes, Teen Science Alliance (TSA), and the Youth Advisory Research Board -- to participate in the summative study for Year 3.

Table 1. Recruitment Sample Sizes

YEAR	Category	Event Name	Target Sample Size	Total Sample
3	Innovation Station 2	Summer Camps and classes recruitment event	4 th & 5 th grade class = ~20 6 th to 8 th grade class = ~20	~50
	Innovation Station 2	OMSI TSA or YARB youth	~10	

Analysis & Reporting

Measurement of participants’ practice of 21st Century Skills, self-efficacy and confidence will be documented via **post-use questionnaires** followed by **a group activities and discussion**. OMSI’s research and evaluation staff will document recruited participants’ use of 21st Century Skills and HCD process by a post-use survey that participants will fill in after focus group activities and discussion. Following their interaction with the Innovation Station, participants will be asked to complete a short questionnaire that asks about their interest in, understanding of, and sense of relevance of the content and the activity as well as demographic information. Participants will be invited to break into pairs to share their responses with another person. This will be

followed by a group discussion facilitated by a project team member to will explore the extent to which participants thought they engaged in 21st Century Skills and aspects of HCD.

OMSI's research and evaluation staff will enter questionnaire data, collected via paper instruments, into an online survey system immediately after each session with the children and youth. Once all data has been collected, an analysis will be conducted and findings will be shared with the project team.

Summative Focus and Questions

The focus of this phase is to evaluate how effectively the experience provides inclusive and accessible learning opportunities (as stated in the project proposal) and meets the project goals. The big idea is: Planning green spaces for our communities can help to reduce racial inequalities that lead to disparities in experiencing urban heat..

Indicators of learning as mentioned by the proposal:

- Participants report interest in the design challenge topic
- Participants report understanding of the design challenge topic
- Participants report that design challenge topic is personally relevant
- Participants report engaging in 21st Century learning and innovation skills and aspects of HCD.

Appendix C - Year 1 Instruments

Appendix C.1: Observation Instruments

Group # _____ Staff _____ Date: _____

Communication breakdown:

Start Time: _____ End Time: _____ Number of people in group: _____

Group composition: child(ren): _____ Youth: _____ Adults: _____

Check the following behaviors are observed by youth in the group, please place a mark:

Behavior	check (if present)	Please describe the elements or activities , if any, you think that most effectively prompted participants to practice <u>the behaviors</u>
Communicates idea - talks using tubes with others in group		
Listens to others -uses exhibit speakers to hear messages		
Uses teamwork : verbalizes with group members		
Manipulate ideas - changes sounds when using tubes		

Brainstorms idea : verbalizes with group before sending message in the tube		
Create an idea - makes a sound or speaks before using the tube aperture		
Demonstrates curiosity : uses/tries another tube		
Respond to feedback : responds to message from tube		
Adapts in response to new ideas : by changing message according to what's heard		
Complete activity: at least one. uses tube and hears		

Please describe the elements or activities, if any, you think that most effectively prompted participants to practice the behaviors above?

Group # _____ Staff _____

Date: _____

Empathy CAD: Empathy Draw:

Start Time: _____ End Time: _____ Number of people in group: _____

Group composition: Child(ren): _____ Youth: _____ Adults: _____

Each time the following behaviors are observed by youth in the group, please mark next to the behaviour

Behavior	check (if present)	Notes
Communicates ideas to others - verbal exchange of focal youth with other(s) in group		
Listens to others : focal individual hear others		
Uses teamwork : works with group members		
Manipulate ideas : manipulates parts- Empathy CAD incorporates more than one card option - E. Draw		

Brainstorms idea : verbalizes/ points at parts or cards with group before drawing or building		
Create an idea : moves parts with orientation or creates drawing		
Demonstrates curiosity : rotates and adjust parts with organization/goes through cards		
Adapts in response to new ideas : by changing parts after first design/ by changing card option after first draw		
Completes activity : creates one space or drawing at least		

Please describe the elements or activities, if any, you think that most effectively prompted participants to practice the behaviors above?

Appendix C.2: Year 1 Post-Interview & Survey

Data Collection protocol

v.5.16.19

This is the standard protocol we use to collect data. We want to make sure that respondents understand that their participation is voluntary, responses are anonymous, and that they are free to quit at any time. In some instances, we also stress that there are not correct or wrong answers, we are simply learning from respondents.

Hi there, we are part of OMSI's exhibit team and we would like to hear about your experience with this activity so we can improve the experience for all visitors. Would you like to participate in a 5-10 minute interview?

If no: "No problem. Thanks very much for your time and have a nice day and enjoy the activities."

If yes: "Great, thank you so much! Just so you know, it should only take about 5-10 minutes, your responses will remain anonymous, and you can quit at any time."

- 1. What would you tell a friend this activity is about?**
- 2. What about the activity was fun or surprising?**
- 3. What, if anything does this exhibit make you want to learn more about or explore further? (Prompt: What did you get out of your experience today?)**

Appendix C.3: Year 1 Survey



OMSI is interested in learning more about your experience with the exhibits. Your feedback is very valuable to us and we appreciate your time. Please answer the questions as thoughtfully and honestly as you can. All of your responses will be confidential. Thank you!



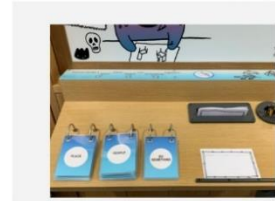
1. Which of the following activities did you do today? Select all that apply.



Played with digital design station



Played with talking tubes



Played with the drawing station



Read reflective panel



Talked to other people in the exhibit



Other: _____

2. Please rate how much you agree with the following statements:



	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The activity gave me the chance to try out more than one idea	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The activity encouraged me to be creative	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The activities relate to my life	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The activity gave me new ideas on how to strengthen relationships within my community	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The activities encourage me to work with others	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Group: _____ Date: _____

3. Please rate your level of agreement with the following statements:

As a result of our visit to Feeling Connected today...

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I increased my understanding of social connections	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I increased my understanding how social connections affect people's health	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I feel more confident in my ability to communicate with other people					
I learned something about communicating with people and considering other perspectives	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



4. We want our activities to be inclusive across gender and racial-ethnic background.

Will you please provide the following demographic information?

What is your age?

- 9-10 11-12 11-14

What is your gender?

- Male Female Another (please specify): _____
 Prefer not to say

With which racial or ethnic group(s) do you identify? (please select all that apply)

- White
 Black or African American
 Hispanic or Latino
 Asian
 American Indian or Alaska Native
 Native Hawaiian or other Pacific Islander
 Multiracial or multiethnic
 Some other race or ethnicity (please specify): _____
 Prefer not to say



Appendix C.4: Year 1 MESA Demo Day Activity

Hello!

This activity is for youth ages 9-14 to participate in an amazing presentation led by the OMSI team.

Once the presentation starts, observe the presenters and use this sheet to rate how they did. For this, consider the INVENT process from MESA. Please give your most honest feedback!

I = Interviewing & empathizing
N = Naming & defining the problem
V = Visioning & ideating
E = Experimenting & making a prototype
N = Engaging the client for feedback
T = Telling the world



Ratings sheet:

	Not well at all	Not so well	Somewhat well	Very well	Extremely well	N/A
Introduced the challenge	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Showed empathy for client considerations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Created problem statements	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Described innovation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Took into account design criteria and constraints	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sought client feedback	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Matched topic with client needs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Communicated ideas well in the presentation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Please use this space to add any other notes. Thank you!

Once finished, please return this form to OMSI staff. Thanks!

Appendix C2: MESA Demo Day questions

Evaluation staff interview questions for the MESA students who participated as “experts.”

-
- What did you enjoy about this process? (prompt about being a juror)
 - What about the presentation, if anything, was confusing or hard to understand?
 - What about the exhibit, if anything, would change or add to make it better?
 - In what ways, if at all, are the exhibit activities and content relevant to your life?

Appendix D - Year 2 Instruments

Appendix D.1: Observation Instrument

Choose a focal youth in the activity

Group # _____ Staff _____

Date: _____

Communication breakdown:

Start Time: _____ End Time: _____

Check the following behaviors are observed by your focal youth in the group, please place a mark:

Behavior	Tally (if present)	Please describe the elements or activities, if any, you think most effectively prompted participants to practice <u>the behaviors or when behaviors occurred</u>
Reads Instruction panel		
Reads label of the exhibit (note which one)		
Orients (observes exhibit, explores around)		

Listens to others first -uses exhibit speakers to hear messages		
Communicates idea - talks using tubes with others in group		
Manipulate ideas - changes sounds when using tubes to explore		

Demonstrates curiosity: uses/tries another tube		
Respond to feedback: responds to message from tube		
Adapts in response to new ideas: by changing message according to what's heard		
Complete activity: at least one. uses tube and hears (write how many times)		
Talk to other person about the exhibit		

Please describe the elements or activities, if any, you think that most effectively prompted participants to practice the behaviors above?

Group # _____ Staff _____

Date: _____

Empathy CAD: Empathy Draw:

Start Time: _____ End Time: _____

Each time the following behaviors are observed by youth in the group, please mark next to the behavior

Behavior	check	Please describe the elements or activities , if any, you think that most effectively prompted participants to practice <u>the behaviors or when behaviors occurred</u>
Reads Instruction panel		
Reads label- write which label reads		

Communicates ideas to others- verbal exchange of focal youth with other(s)		
Listens to others: focal individual hear others		
Uses teamwork: works with others		
Manipulate ideas: manipulates parts- Empathy CAD incorporates more than one card option - E. Draw		

Brainstorms idea: verbalizes/ points at parts or cards with group before drawing or building		
Create an idea: moves parts with orientation or creates drawing		
Demonstrates curiosity: rotates and adjust parts with organization/goes through cards		
Adapts in response to new ideas: by changing parts after first design/ by changing card option after first draw		
Completes activity: creates one space or drawing at least (write in notes if more than one)		

Please describe the elements or activities, if any, you think that most effectively prompted participants to practice the behaviors above?

Appendix D.2: Group Discussion

1. Could you tell us why the exhibit is in OMSI? Why did OMSI put together?
2. What would you tell a friend this activity is about? (prompt: think about what you were doing or read).
3. What about the activity was fun or surprising? (prompt. think about what you saw or what you did).
4. What about the activity , if anything, was confusing or hard to understand? (prompt the activity, parts of the activity, text, words)
5. What about the exhibit, if anything, would change or add to make it better? (prompt the activity, parts of the activity, text, words)
6. In what ways, if at all, are the exhibit activities and content relevant to your life? (prompt. consider pandemic, communicating with your friends, social distance? Can you talk about how?)
7. Did this get you to think of people getting together? and how connections to people improve our health? Why yes? why not?

Appendix D.3: Questionnaire

Now that you are finished interacting with the exhibit, we will share some questions. Please feel free to walk around the exhibit if that helps to answer the questions. Feel free to write, draw, or just use a word. We will take ~10 minutes.

1. Could you tell what the activity is about? (please circle one option and write about your response)
 - If YES. What do you think this activity was about? Write as if you were explaining to a friend? (consider what you were doing or what you read)
 - If NO. What do you feel made it difficult to tell what the activity is about? (you can choose one activity or what you read)

2. What, if anything, did the activities make you think about or remember?

3. What did you think of the clarity of the text or words in the activity? (the words used, the amount of words, easiness to read)

4. What, if anything did you learn from doing the activity or reading the text?

Appendix D.4: Survey



OMSI is interested in learning more about your experience with the exhibits. Your feedback is very valuable to us and we appreciate your time. Please answer the questions as thoughtfully and honestly as you can. All of your responses will be confidential. Thank you!



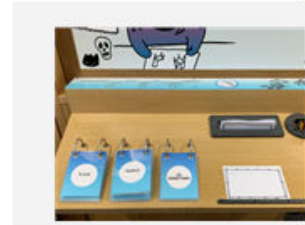
1. Which of the following activities did you do today? Select all that apply.



Played with digital design station



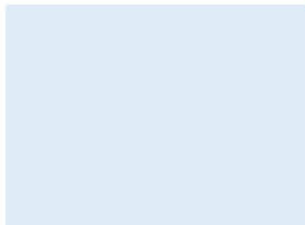
Played with talking tubes



Played with the drawing station



Read reflective panel



Read instruction Panel



Other: _____

2. Please rate how much you agree with the following statements:



	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The activity gave me the chance to try out more than one idea	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The activity gave the chance to learn from an idea and try it again	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The activities relate to my life	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The activity gave me new ideas on how to strengthen relationships within my community	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The activities encourage me to understand other people's needs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Group: _____ Date: _____



3. Please rate your level of agreement with the following statements:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I increased my understanding how social connections affect people's health	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I feel more confident in my ability to communicate with other people	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I learned something about communicating with people and considering other perspectives	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I learned that social connections help people to stay healthy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I learned that social connections help people in their emotional well being	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

4. We want our activities to be inclusive across gender and racial-ethnic background.

What is your age?

- 9-10
 11-12
 13-14
 15-16
 17- or up

What is your gender?

- Male
 Female
 Another (please specify): _____
 Prefer not to say

With which racial or ethnic group(s) do you identify? (please select all that apply)

- White
 Black or African American
 Hispanic or Latino
 Asian
 American Indian or Alaska Native
 Native Hawaiian or other Pacific Islander
 Multiracial or multiethnic
 Some other race or ethnicity (please specify): _____



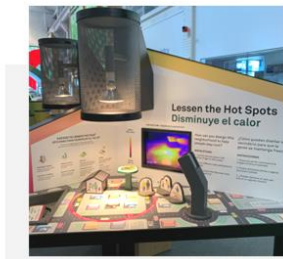
Appendix E - Year 3 Instruments

Appendix E.1: Child Survey



OMSI is interested in learning more about your experience with the exhibits. Your feedback is very valuable to us and we appreciate your time. Please answer the questions as thoughtfully and honestly as you can. All of your responses will be confidential. Thank you!

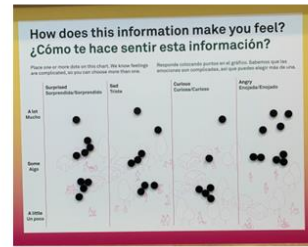
1. Which of the following activities did you do today? Select all that apply.



Played with Lessen the Hot Spots / Disminuye el calor



Read Inspirational Change / Un cambio que inspira graphics



Played with How does this information make you feel? / ¿Cómo te hace sentir esta información?



Watched the video



Read main information























Other: _____

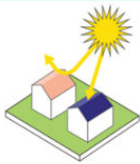
2. Please rate how much you agree with the following statements:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The activities gave me the chance to try out a design solution					
The activities allow me to work with other classmates					
The activities allowed me to try many solutions					

Continuation....

2. Please rate how much you agree with the following statements:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
					
The activities were interesting for me					
I felt confident trying solutions for the heat problem					
I think of myself as a science person					



4. We want our activities to be inclusive across gender and racial-ethnic background.

What is your age?

What is your gender?

Male Female Another (please specify): _____ Prefer not to say

With which racial or ethnic group(s) do you identify? (please select all that apply)

- White
- Black or African American
- Hispanic or Latino
- Asian
- American Indian or Alaska Native
- Native Hawaiian or other Pacific Islander
- Multiracial or multiethnic
- Some other race or ethnicity (please specify): _____
- Prefer not to say



Appendix E.2: Youth Survey



OMSI is interested in learning more about your experience with the exhibits. Your feedback is very valuable to us and we appreciate your time. Please answer the questions as thoughtfully and honestly as you can. All of your responses will be confidential. Thank you!

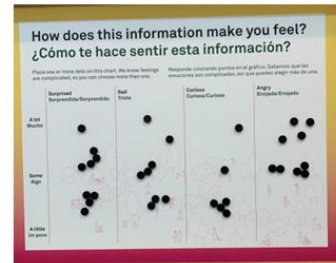
1. Which of the following activities did you do today? Select all that apply.



Played with Lessen the Hot Spots / Disminuye el calor



Read Inspirational Change / Un cambio que inspira graphics



Played with How does this information make you feel? / ¿Cómo te hace sentir esta información?



Watched the video



Read main information



Other: _____

2. Please rate how much you agree with the following statements:



	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
The activities gave me the chance to share my ideas with others	1	2	3	4	5
The activities allow the opportunity to collaborate with others	1	2	3	4	5
The activities gave me the chance to try out a design solution	1	2	3	4	5
The activities allow me to test multiple solutions	1	2	3	4	5
The activities encourage me to understand social problems	1	2	3	4	5
The content provided relate to my life	1	2	3	4	5

3. Please rate your level of agreement with the following statements.

As a result of our visit to Heat Inequality today...

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
	1	2	3	4	5
I increased my understanding how heat affects different neighborhoods	1	2	3	4	5
I feel more confident in my ability to try solutions to the heat problem	1	2	3	4	5
I feel more confident in my ability use the information to solve the problem	1	2	3	4	5
I increased my interest in heat and their impacts	1	2	3	4	5
I think of myself as a science person	1	2	3	4	5



4. We want our activities to be inclusive across gender and racial-ethnic background.

Will you please provide the following demographic information?

What is your age?

- 11-12
- 13-14
- 15-16
- 17- or up

What is your gender?

- Male Female Another (please specify): _____ Prefer not to say

With which racial or ethnic group(s) do you identify? (please select all that apply)

- White
- Black or African American
- Hispanic or Latino
- Asian
- American Indian or Alaska Native
- Native Hawaiian or other Pacific Islander
- Multiracial or multiethnic



APPENDIX E.3: Data Collection Protocol for Children/ Youth Testing

Hello, my name is _____ and I work at the Oregon Museum of Science and Industry. We are working on improving an exhibit, and we're hoping to get some help to make our exhibit as fun and interesting as possible. Please do not be shy or worry about being critical. We value your feedback! Thank you for agreeing to participate!

First, I would like to let you know that:

- There are no right or wrong answers. We value your perspective and ideas.
- This activity is to gather your feedback about the exhibit--it is not about you
- Your answers will be completely anonymous, meaning that your responses will not be attached to your name nor will we share your name.
- You can stop anytime you want
- You can skip questions

Second, we would like to ask you to think of yourself as our guide or researcher through this process. **Think about someone your age (or if older think about someone ages 9-14).** For that we would like to invite you to interact (or play) with this exhibit for about 5 minutes.

Now that you are finished interacting with the exhibit, we will share with you papers with some questions. We encourage you to walk around the exhibit, if that helps to answer the questions. Feel free to write, draw, or just use a word. We will take about 5 minutes for this activity.

After the five minutes has passed, we would like you to find a partner (or classmate) and have a conversation about the questions asked on the first page. If you do not feel like sharing your answers, please consider the areas/things that you like most from the exhibit/activities and the messages that you read. For example, What did you like most? What did you like least? What would you change? We will give you 5 minutes to discuss in your groups.

For the next step, we will take 10-15 minutes to have a group conversation. We are learning from you and want to use this as an opportunity to hear your thoughts, impressions, and feedback about the exhibit.

As a final step, we would like to ask you to complete a final survey individually. Once you are finished with the survey, we will be finished.

Thank you for taking the time to share your thoughts and ideas with us!

Appendix E.4: Grades 4th - 5th Post Group Discussion

Now that you are finished interacting with the exhibit, we will share some questions. Please feel free to walk around the exhibit if that helps to answer the questions.





[Using sticky easel paper, write each of the following questions in a paper. Read questions to participants. Provide sticky notes and pencils so, participants could write their answers]

1. If you were telling a friend about these activities, please write one word or one sentence that you would use to share about these activities

[Read 2-3 responses and ask them if the responses are similar. Ask participants to help you move similar responses in groups as you read them. in the end this activity will help having the themes for this response]

For the next activity we are going to have some sentences written on this piece of paper [point to the paper]. We will read each of the sentences and you can let us know how much you agree with by putting the stickers we are handing-out under the sentences, without placing it on top of another sticker. Each color means something different...

[Provide stickers of colors and show the code for them in a paper and ask participants to use them for each question in the easel paper]

	Strongly Disagree [disagree a lot]
	Disagree
	Agree
	Strongly Agree [Agree a lot]

2. The activities were engaging
3. the activities are about heat and how affects different neighborhoods

4. the activities showed a problem that needs to be solved
5. the activities were confusing or hard to understand

[once participants have finished, follow this last question and ask them to share what was confusing to understand].

For the next activities ask participants to write one word or one sentence in their sticky notes and share it in pairs. Once finished, ask participants to stick their responses in the easel.

6. What about the activity, if anything, was confusing or hard to understand? (prompt: consider the activity, parts of the activity, the text, and the words)

7. In what ways, do the activities you did or saw relate to your life, if at all? (prompt: what part of what you did or saw reminds you of your life, neighborhood, family, or friends) write 1-2 sentences

Thanks!

Appendix E.5: Grade 6th And Up Group Discussion

Facilitator Instructions

1. Using sticky easel paper, write each of the following questions in a paper.
2. Provide sticky notes and pencils so participants can write their answers
3. Read instructions and questions to participants.
4. If needed, also hand out a printed copy of the questions.
5. Once participants have finished, ask if they can pair with a teammate and share their responses--give them 2-5 minutes
6. Start the group activity.
 - a. Read question
 - b. Gather sticky note responses from participants
 - c. Theme each question responses with participants
 - d. Repeat for each question.

Activity Questions

Now that you are finished interacting with the exhibit, we will share some questions. Please feel free to walk around the exhibit if that helps to answer the questions. Write one sentence per question.

- 1. If you were telling a friend about these activities, please write sentence that you would use to share about these activities**

- 2. What about the activity, if anything, was confusing or hard to understand? (prompt: think about the activity, parts of the activity, the text, or the words) Please write one sentence to explain.**

- 3. In what ways, if at all, are the exhibit activities and content relevant to your life? (prompt: consider your neighborhood, community, school, park) Please write one sentence to explain how they are relevant?**

Appendix E.6: OMSI and MESA Collaboration Discussion Questions

After Year 3 and before the project wrap up evaluation and project staff will meet MESA staff to have two one-hour conversations regarding the collaboration.

Overarching Questions

For OMSI-E:

- How do organizations form a relationship with OMSI, and how does that relationship develop?
- How is the lived experience of OMSI partners?
- For the KOIs: What measures are most important to partners in terms of assessing the quality and strength and the depth of a partnership?
- What is the meaning and the future of partnerships with OMSI?

EM-X

- What benefits do OMSI staff and MESA report? (from the partnership and through the project activities)
- From the collaboration, what was effective?
- How do both organizations intend to maintain the collaboration model?

Agenda below:

Conversation 1

-Welcome

-Questions:

1. When you think of stories of the EM-X project or OMSI partnership, what would you tell or share?
2. Based on your understanding of the project goals, what do you see as effective in the collaboration through the entire project? What was effective for this Year 3 of the project? (prompts: what are your perspectives on the project process, interest and opportunities for the HCD - INVENT toolkit)
3. What have been the most valuable lessons you've learned as a partner on this project? as a partner of OMSI overall?
4. How, if at all, has the partnership or collaborative nature of the EM-X project been most challenging? What suggestions and lessons do you have for OMSI staff?
5. How, if at all, has the partnership or collaborative nature of this project been most successful?

Next steps

Thanks!

Conversation 2

-Welcome

-Questions:

1. Looking at the future collaborating with OMSI, what opportunities can you foresee? (prompt opportunities through the HCD toolkit in the OMSI setting and with multiple stakeholders)

2. Looking at the future collaborating with OMSI, what challenges can you anticipate?
 - a. How do you think challenges could be addressed or improved in future?
3. What are some ways you intend to help sustain the partnership or collaboration beyond this grant?
4. What are some ways you think that OMSI could sustain the partnership or collaboration beyond this grant?

Next steps

Thanks.

Appendix F – Report Summaries

Appendix F.1: Year 1 Professional Report

EXECUTIVE SUMMARY

PROJECT DESCRIPTION

The Oregon Museum of Science and Industry's (OMSI) *Evolving the Museum Experience: Human-Centered Design to Inspire Creative Community-Based Solutions (EM-X)* project, funded in part by an Institute of Museum and Library Services (IMLS) MA-10-18-0388-18, Learning Experiences grant explored the creation of content while building staff capacity and engaging in partnerships. The project goal is to create hands-on design challenges that inspire diverse youth and families to use 21st century skills (IMLS, 2016) to imagine and test solutions to real-world problems. The design challenges allow OMSI to integrate dynamic experiences based on community input into our Center for Innovation (C4I—an exhibition hall) and Statewide Outreach strategic initiatives. To accomplish this goal, OMSI will work closely with Oregon MESA (Mathematics Engineering Science Achievement)—the local branch of a national organization that uses human-centered design challenges to teach STEM, invention, and 21st century skills to middle and high school students historically underrepresented in STEM fields. INVENT is a MESA invention toolkit and process adapted from the Human Centered Design (HCD), design thinking, engineering design, and entrepreneurship approaches. INVENT stand for: Intertwining and empathizing, Naming and defining the problem, Visioning and inspiring ideation, Experimenting and making a prototype, eNgaging client feedback, Telling the world! Leveraging this process, MESA teaches STEM, invention, and 21st Century Skills to middle and high school students historically underrepresented in STEM fields. Underrepresented students, here, are defined as students of color, girls, recent immigrants and refugees, impoverished populations, and first generation college students. By collaborating, OMSI and MESA will be able to create clearer, more meaningful paths through the Oregon STEAM-learning ecosystem for youth and families.

The objective of the summative evaluation for Year 1 was to gain systematic reflection and track progress of the processes for the OMSI and MESA collaboration and the extent of staff skills and confidence incorporating HCD to create content with target audiences and partners. The professional evaluation strand has two goals: (1) evaluate the collaborative model of OMSI and MESA and how the process used contributes to the collaboration model, and (2) evaluate how the Human-Centered Design (HCD) supported building teams' capacity.

STUDY DESCRIPTION

Evaluation activities outlined in this report pertain to the project's professional strand. Through this strand, OMSI aimed to identify and document the progress of Year 1 outcomes for the collaborative model to increase MESA and OMSI staffs' skills and confidence incorporate HCD to create content with target audiences and partners.

KEY FINDINGS

Below are key project findings that correspond to Year 1 summative evaluation questions.

MESA COLLABORATION

Both OMSI and MESA staff stated that the collaboration has been beneficial for their organizations, the staff involved, and the audiences they serve.

Both organizations intend to continue the collaboration through the next grant year by working closely on the planned deliverables and events, and by communicating on a regular basis.

HUMAN-CENTERED DESIGN (HCD)

Project participants found the HCD-INVENT process useful for articulating the deliverables for Year 1; specifically, the exhibit bay. INVENT is a MESA invention toolkit adapted from the Human Centered Design (HCD), design thinking, engineering design, and entrepreneurship approaches. INVENT stand for: **I**ntertwining and empathizing, **N**aming and defining the problem, **V**isioning and inspiring ideation, **E**xperimenting and making a prototype, **eN**gaging client feedback, **T**elling the world!

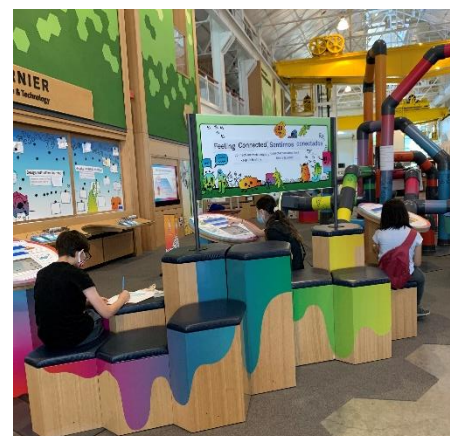
Different levels of familiarity with the HCD approach influenced participants' levels of understanding and confidence using the HCD to create content with partners after the MESA training.

Project participants reported interest in using parts of the INVENT process in the future, specifically, interviewing (I), empathizing (E), diving deeper in steps such as Visioning and Inspiring Ideation (V), and Experimenting and making a prototype steps (E).

RECOMMENDATIONS FOR OMSI STAFF

- 1 To advance collaboration with MESA, communicate quarterly project goals, updates, and expectations.
- 2 To further collaboration with MESA beyond the grant period, seek opportunities to brainstorm and/or ideate paths for a sustainable model. Consider submitting additional grant proposals together.
- 3 To continue staff capacity building through the HCD approach, consider providing additional time for intentionally implementing the INVENT steps in for the next deliverable.

Appendix F.2: Year 2 Formative Summary



EVOLVING THE MUSEUM EXPERIENCE – EM-X: Synopsis of Formative Findings

Year 2

v.9.21.20, CH

Data gathered through formative evaluation in the Innovation Station 1 (DC1): *Feeling Connected* suggests that this experience includes characteristics that convey the main message of *Feeling Connected*.

Feeling Connected activities communicate the main message that connecting with people improves mental and physical health, and it is therefore important to design solutions for connecting with people by considering other people's needs.

Examples:

1. Learn the use of empathy to understand other people's needs
 - o Youth were observed considering the communication or space, or considering/accommodating the needs of others.
2. Ideas: Try more than one idea and learn from it
 - o Youth were observed creating a space, in *Empathy CAD/Draw*, or talking through tube in *Communication Breakdown*.
3. Designs in response to specific ideas or needs
 - o Through observation or self-report, the data suggests that activity gave youth ideas or helped youth responded to specific concepts during the activity.
4. Labels
 - o Youth were observed reading labels and panels or reported the clarity of the text used.

Youth captured the main message:

- o About half of the participants reported that the activity was about considering other's needs (empathy) (survey respondents and group discussions)
- o About half of the participants reported that the activities gave opportunities to try more than one idea.
- o Slightly more than half of the participants reported that the labels were clear and easy to understand. Suggestions were tied to engagement, amount of text, instructions, connection to content.

Data show little evidence that participants' designs responded to specific ideas or needs.

Areas that the experience can be strengthened

Although survey responses suggest that the activities gave participants the chance to try more than one idea, it is unclear as to what participants learned during their interactions.

the activity gave me a chance to try out more than one idea	Strongly Agree (7)	Agree (6)	Neither agree nor disagree (1)	Disagree (0)	Strongly Disagree (1)
the activity gave the chance to learn from an idea and try it again	Strongly Agree (4)	Agree (7)	Neither agree nor disagree (2)	Disagree (1)	Strongly Disagree (1)

Open-ended questions and group responses suggest that youth made connections with the messaging of the activities (being aware of the space, designing considering the needs of others, and connecting the activity to communicating with others within the current context.

Design in response to specific ideas or needs

Data provided little evidence for this indicator.

the activity gave me new ideas on how to strengthen relationships within my community	Strongly Agree (6)	Agree (3)	Neither agree nor disagree (2)	Disagree (3)	Strongly Disagree (1)
---	---------------------------	------------------	---------------------------------------	---------------------	------------------------------

Although participants did not directly mention or report that their designs and/or interactions were based on specific ideas or needs, some youth included wording in their open-ended responses that suggests that youth understood what the activity was about and learned from the activities.

Appendix F.3: Year 3 Public Report Summary

EXECUTIVE SUMMARY

PROJECT DESCRIPTION

The report discusses the Oregon Museum of Science and Industry's (OMSI) *Evolving the Museum Experience: Human-Centered Design to Inspire Creative Community-Based Solutions (EM-X)* project, which was funded in part by an Institute of Museum and Library Services (IMLS) Learning Experiences grant (MA-10-18-0388-18). The project goal was to create hands-on design challenges that inspire diverse youth and families to use 21st Century Skills¹ to imagine and test solutions to real-world problems. The Design Challenges allow OMSI to integrate dynamic experiences based on community input into OMSI's Center for Innovation (C4I—an exhibition hall) and Statewide Outreach strategic initiatives. To accomplish this goal, OMSI worked closely with Oregon MESA (Mathematics Engineering Science Achievement)—the local branch of a national organization that uses human-centered design challenges to teach STEM, invention, and 21st Century Skills to middle and high school students historically underrepresented in STEM fields.

STUDY DESCRIPTION

The objectives for the public strand of the summative evaluation for Year 3 was to assess the extent by which the Heat Inequality Design Challenge (DC) encouraged program participants to practice 21st Century Skills [Learning and Innovation Skills]. The DC was also evaluated on its ability to foster awareness of the content and provide content and design challenges that are personally relevant for the participants. Additionally, evaluators assessed if the DC encouraged participants to 1) practice and address real-world problems, 2) feel a sense of self-efficacy regarding their ability to problem solve, 3) try multiple solutions, and 4) be a STEAM learner.

To achieve this phase's objectives, the OMSI Research & Evaluation team addressed evaluation objectives using a mixed-methods approach that included post group discussions and post individual self-report surveys. Data collection was conducted during a week in the Turbine Hall at the Design Challenge *Heat Inequality* DC Innovation Station 2 area.

KEY FINDINGS

Below are key project findings that correspond to Year 3 evaluation questions.

ENGAGEMENT IN 21ST CENTURY SKILLS

According to the survey responses 60% of the participants strongly agree or agree that the DC activities gave them the chance to try out a design solution, 59% of the participants strongly agree or agree that the DC activities encouraged them to understand social problems, 55% of participants strongly agree or agree that the DC activities gave the chance to share ideas with others, 59% of the participants strongly agree or agree that the DC activities allow the opportunity to collaborate with others.

¹ IMLS (2009). *Museums, Libraries and 21st Century Skills*.
<https://www.imls.gov/sites/default/files/publications/documents/21stcenturyskills.pdf>

SELF-EFFICACY TO PROBLEM SOLVE

According to survey responses 53% of the participants strongly agree or agree that as a result of their visit to *Heat Inequality*; they felt more confident in their ability to try solutions to the heat problem, 42% of the participants strongly agree or agree that they felt more confident in their ability to use the information to solve the problem, 60% strongly agree or agree that the activities allowed them to test multiple solutions, 50% reported thinking of themselves as a science person.

CONTENT AWARENESS

According to survey responses, 73% of the participants strongly agree or agree that as a result of their visit to *Heat Inequality*; they increased their understanding of how heat affects different neighborhoods. In the group activities participants mentioned that stories they would share about the activity would be about heat inequalities, race and inequalities, and climate change impacts.

PERSONALLY RELEVANT AND INTERESTING CONTENT

About half of the survey participants reported that the content related to their life and that their visit increased their interest in heat and its impacts. Overall, during the group discussions participants verbalized that they could make connections of the content to their life. For example, some expressed that the city of Portland map provided relatable context for participants. Younger participants, in general, did not answer these questions through either the group discussions or the open-ended questions.

DISCUSSION

The Heat Testing station as the only hands-on challenge fostered engagement in the 21st Century Skills. Through this activity participants were observed working in groups testing ideas and finding solutions to the heat problem. Future DC would benefit from having different hands-on challenges that offer different opportunities to practice these skills. Additional and different opportunities for hands-on challenges could also foster opportunities for self-efficacy when problem solving and seeking solutions. The labels in the DC, provided context for the topic and reinforced the big idea and content as a social and environmental issue that supported content awareness. Feedback from participants suggest that the content relevance and interest could be improved. Future considerations need to take into account exhibit components that are part of future DC's given that 9 to 14 years old is a broad range in terms of developmental interests and skills of a person.

Appendix F.4: Year 3 Professional Report Summary

EXECUTIVE SUMMARY

PROJECT DESCRIPTION

The report discusses the Oregon Museum of Science and Industry's (OMSI) *Evolving the Museum Experience: Human-Centered Design to Inspire Creative Community-Based Solutions (EM-X)* project, which was funded in part by an Institute of Museum and Library Services (IMLS) Learning Experiences grant (MA-10-18-0388-18). The project goal was to create hands-on design challenges that inspire diverse youth and families to use 21st century skills to imagine and test solutions to real-world problems. The design challenges allow OMSI to integrate dynamic experiences based on community input into OMSI's Center for Innovation (C4I—an exhibition hall) and Statewide Outreach strategic initiatives. To accomplish this goal, OMSI worked closely with Oregon MESA (Mathematics Engineering Science Achievement)—the local branch of a national organization that uses human-centered design challenges to teach STEM, invention, and 21st century skills to middle and high school students historically underrepresented in STEM fields. INVENT is a MESA invention toolkit and process adapted from the Human Centered Design (HCD), design thinking, engineering design, and entrepreneurship approaches. INVENT stands for Intertwining and empathizing, Naming and defining the problem, Visioning and inspiring ideation, Experimenting and making a prototype, eNgaging client feedback, and Telling the world. Underrepresented students, here, are defined as students of color, girls, recent immigrants and refugees, impoverished populations, and first generation college students. By collaborating, OMSI and MESA was able to create clearer, more meaningful paths through the Oregon STEAM-learning ecosystem for youth and families.

STUDY DESCRIPTION

The objective of the summative evaluation for Year 3 was to gain systematic reflection and track progress of the processes for the OMSI and MESA collaboration and the extent of staff skills and confidence incorporating HCD to create content with target audiences and partners. The professional evaluation strand has two goals: (1) document the collaborative process of OMSI and MESA and (2) evaluate how the Human-Centered Design (HCD) supported building OMSI team's capacity.

Evaluation activities outlined in this report pertain to the project's professional strand. The evaluation for this strand aims to assess both the collaborative model of OMSI and MESA and how the Human-Centered Design (HCD) supported building OMSI team's capacity.

KEY FINDINGS

Below are key project findings that correspond to Year 3 evaluation questions.

MESA COLLABORATION

MESA staff stated that the collaboration was beneficial for their organization, the staff involved, and the audiences they serve.

Participants are interested in maintaining and building a post-grant relationship with OMSI. There were several suggestions to help support the organizations' relationship:

1. Designate point people from each organization who will maintain consistent, frequent, and transparent communication.
2. Support one another by attending each other's events.
3. Set annual equity and access partnership goals that transcend specific projects. These goals would be evaluated annually, with check-ins taking place throughout the year.

HUMAN-CENTERED DESIGN (HCD)

Overall, OMSI staff found HCD to be a useful approach, with some participants particularly interested in the collaborative nature of the process. While some staff had no interest in using HCD in the future, most of OMSI staff were interested in using the approach in other projects.

RECOMMENDATIONS

1. Early in a project, OMSI staff should establish a process for working with the partner organization that includes protocols and communication plans for each branch of OMSI involved in the project (e.g. Programs team, Business and Development departments).
2. OMSI should communicate with project partners through regular check-ins. Provide updates and discuss timeline, budgets, key documents, and shared understandings.
3. Prior to the end of the project, a plan to maintain the relationship after grant funding is over should be co-developed.
4. To realistically use HCD, it needs to be considered during project scoping to ensure that enough time and funds are allocated to properly use the approach.
5. Integrating portions of the INVENT process into current projects may be useful in scaffolding the use of HCD in future projects and a way to build staff capacity and familiarity with this approach.