Design Challenge Resource Collection

Module 9: Documenting Exhibits - The Exhibit Record Tool

This module is part of a Design Challenge Resource Collection, developed by a cross-functional team at the Oregon Museum of Science and Industry (OMSI) with decades of experience conceptualizing, developing and building museum exhibits. The collection is intended to support exhibit developers and designers as they work to create interactive design challenges.

These modules are designed for someone to read individually or facilitate with a team. There are great benefits derived from collaborating on the exhibit development process. Throughout the modules, activities for groups of individuals are called out in blue boxes.

Team Activity

Discussion prompts and other activities for groups are in blue boxes like this one.

Each module stands alone; there is no specific order to explore the modules, nor is there a need to read them all. However, in some cases, references are made between modules for opportunities to learn more. Finally, these resources are not meant to be prescriptive, but rather examples, tools and approaches the OMSI team has found valuable in the development of non-facilitated engineering design challenge exhibits for the museum floor that are accessible, relevant and engaging for visitors.

The entire set of resources can be found on the *Design Challenge Resource page*

1. Introduction to Design Challenges
2. Exploring Design Challenges
3. Approaches to Exhibit Accessibility
4. Testing a Design: Measures of Success.
5. Exhibit Design Sprints
6. Graphic Development for Design Challenges
7. Prototyping Design Challenge Exhibits
8. Participatory Co-development of a Bilingual Exhibit
9. Documenting Exhibits: The Exhibit Record Tool

This material is based upon work supported by the National Science Foundation under Grant No. DRL-1811617. 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 National Science Foundation.

Documenting Exhibits - The Exhibit Record Tool

An exhibit record is a tool that is key to successful exhibit development. While the format can change slightly depending upon the stage of development, the purpose remains the same: to document and communicate about the goals, functions, and features of an exhibit component. In early stages of development, the exhibit record is a place to state goals for the exhibit and experience, and to identify potential concerns or issues. It provides a concise description that can be used with partners and advisors who will provide input on exhibit ideas. Ultimately, it becomes documentation of exhibit details that can be archived and referred back to as needed. Possible parts of an exhibit record are described below and several examples are provided. Ultimately, it is up to the exhibit team to decide what information is important to document and share;customization and evolution of the exhibit record tool is encouraged.

Exhibit Title: The working name of the component. Developers may assign a number to exhibit components so that it is easier to track iterations of an exhibit even if the working name changes. For example, through the development process of what ultimately became "Collaborate" started as "Vertical Garden," then "Rooftop Garden," and was colloquially referred to as "the Garden Game" amongst the team. Throughout the process however, all exhibit records were numbered '02' followed by the name at the time. This helped keep those records together and reduced confusion.

At a Glance: A brief summary of the component. Usually a few sentences, this captures the overall idea of the exhibit, what visitors will do and what they will experience.

Component Needs: A list of everything that will be needed for the ultimate exhibit component and experience. While this does not need to be a detailed, technical inventory, it should include things such as graphic needs, space requirements, work spaces, test beds, materials, etc. The component needs list helps the team anticipate the resources that will be needed to fabricate the exhibit.

Target Audiences: If the exhibit is being developed for a specific age range or demographic, that is recorded here. This information is valuable to people who may be reviewing and providing feedback, but who are not steeped in the project.

Experience Goals: A description of the intended visitor experience. What it is that you want visitors to do, learn and feel. Articulating the goals for the component can help ensure that the exhibit you are developing delivers the experience and learning outcomes you want. Experience goals can also help inform decisions about design, construction, technology, and materials that will best achieve those goals. For an engineering design challenge, this may mean decisions on what materials are provided and how feedback is presented.

Exhibit Description: The exhibit description explains exactly what happens in terms of steps visitors need to take to do the activity and information that will help designers, engineers, and technologists make the exhibit do what it needs to. This often includes **Visitor Experience** and **Notes on Function**, and could include flow diagrams, maps, tables, etc. Often, a visual description of things is a better method to communicate how you want the exhibit to behave. A set of check boxes of common exhibit characteristics can help track individual components across an entire exhibition and help a team determine if the components offered and if the visitor experience will be well balanced.

Exhibit Component Type					
Mechanical	☐	Software	☐	Full body	☐
Computer	☐	Video	☐	Multi-user	☐
Electronics	☐	Audio	☐	Graphic Panel	☐
Immersive	☐	Collaborative	☐	Digital Readout	☐

Visitor Experience: A step by step description of what visitors will see and do at the component. If written before other parts of the exhibit record, the visitor experience description can inform the exhibit description and component needs. Often included as part of the exhibit description.

Notes on Function: Particularly important early in the development process, the notes on function describe how key aspects of the exhibit should work or what they need to do. These are often thoughts regarding details that will need to be considered as development progresses. With design challenge exhibits, this section will include information about feedback to visitors and indicators of success.

Accessibility Considerations: Thinking about the needs of all potential users is essential and developers should begin thinking about accessibility considerations early in the process. Imagine how the exhibit will be perceived by individuals with different abilities or those who speak a different language. What features can you incorporate to improve the experience?

Family-friendly Considerations: Several studies outline features of exhibits and spaces that are appealing to visitors and conducive to family learning. Identify as a team which are important to you and include ideas for how to support them in this space. Resources such as *https://engagefamilies.org/* are a great place to start when thinking about family-friendly considerations.

Notes on Environment, Copy and Visual Content: What are the special touches that will help communicate to visitors and make the exhibit exceptional?

Items to Nail Down: Key early in the development process, this is a list of things that still need to be determined or decided. These could include types of materials to be used, vendors or contractors, specific equipment or anything else. Items may be general and speculative (e.g. how will we reset the experience?) to specific (e.g. will we use laminate or direct to ply?)

Main Messages Supported: Many exhibit projects have a specific Big Idea, and main messages they hope to convey to visitors through the experience. Documenting which of these are addressed by each component can help ensure that the exhibition as a whole meets its goals and that every component is supporting the Big Idea.

Key References: A place to record sources of important data or digital assets. Sometimes people have used the exhibit record to document formative evaluation findings (i.e., justify choices).

A blank template and examples are below. Add to and modify the template to best serve your project.

Sample Blank Exhibit Record Tool

Developers:		**Designers:**		**Production Manager:** **Tech Developer:**	

Example 1

Exhibit Title

Component Needs:

Target Audiences:

Experience Goals where *(Visitors do/learn/feel...)*

Visitors do:

-

Visitors learn:

-

Visitors feel:

-

Visitor Experience

Step-by-step:

Exhibit description

Exhibit Component Type					
Mechanical	☐	Software	☐	Full body	☐
Computer	☐	Video	☐	Multi-user	☐
Electronics	☐	Audio	☐	Graphic Panel	☐

At a glance:

Accessibility Considerations:

-

Family-friendly considerations:

-

Items to Nail Down:

Notes on Copy and Visual Content:

-

Main Messages Supported		

Key references:

Example 1

#A02 *Blowing In the Wind*

Component Needs:

- 2 horizontal air tunnels
    - o Button to start fan
    - o Knob to control fan speed
- 2 build stations
- Chairs or stools
- Graphic panels
- Copy and illustrations
- Computer/monitor or iPad for video
- Kinetic sculpture materials (TBD, but likely include: lightweight blades with notches for connecting them to spinning center or each other; streamers; feather boas)

Experience Goals

- **What visitors do:** Visitors design and build kinetic sculptures that spin at different rates.
- **What visitors learn:** Visitors learn that engineering is creative, and that there are similarities between engineering and making art.
- **What visitors feel:** Creativity. Delight. Surprise that artists can also be engineers.

Exhibit description

At a glance:

- At two stations, a fan blows air horizontally.
    - o There is a spot where visitors can attach their kinetic sculptures to be tested in the "wind." A button starts the fan and a knob adjusts air strength.

- Next to the air tunnel is a build station with a tabletop low enough for children to reach.
  - Materials are provided in bins at the build station.
  - Above the build station are graphic panels explaining the design challenge and offering an illustrated engineering story. Near the graphic panels is also a monitor displaying looping video of real-life kinetic sculptures.

Notes on Environment:

•

Notes on Copy and Illustrations:

- Bilingual copy, heavily supported by illustrations.
- Illustrations contextualize activity with personal relevance by scene-setting within a community garden. Copy emphasizes that engineering is creative, and that there are similarities between engineering and making art.

Details to Nail Down:
- Specifics of design challenge still under consideration.

Visitor experience

Step-by-step, what the visitor does:

- Notices people testing kinetic sculptures, and walks to build station in search of materials.
- Reads about kinetic sculpture on the graphic panels, and watches video of a real-life example.
- Looks to instructions for how to build a sculpture. Starts designing a sculpture that will move quickly.
- Builds sculpture. Tests by attaching sculpture inside air tunnel and pushing button to start fan. Turns air speed up with knob. Refines design, tests again, and repeats until satisfied with product.
- During the process, turns to friends, family, and/or other visitors for advice and praise.

Why is this fun?

Visitors get to be creative and imaginative. It's a crafty activity with aesthetically-pleasing results.

How is it social?

The intent of public art is inherently social. Visitors watch each other test sculptures and they react together over the results. They can collaborate with one another or build simultaneously side-by-side.

How is it personally relevant?

Kinetic sculptures offer an entry point to engineering for kids who enjoy crafts or art. Many of these participants may be intimidated or turned off by traditional STEM topics, but they learn here that engineering skills are applicable and sometimes necessary for creative pursuits.

How is it altruistic?

Engineering empowers art.

How is it an engineering challenge?

Visitors engage in an iterative design process as they build and test their sculptures. They must consider practical concerns like durability, and conceptual challenges like how pieces of the sculpture will interact when they move and what makes a sculpture move relatively fast or slow.

Example 2

Developers: Karyn, Cecilia
Designer: Kirby
Production Lead: Tim
Software Developer: Libbey

B9 *Design a Wheelchair*

Visitor Learning Goals *(Visitors do/learn/feel…)*

1. Visitors engage in steps of the engineering process to meet the needs of a user with disabilities.
2. Visitors receive feedback about their designs from the user.
3. Visitors discover constraints and trade-offs as they choose design features to create a technological solution to meet a user's goal.

Experience description

At a glance:

Touchscreen computer interactive with physical pieces representing various parts of wheelchairs that visitors arrange in order to test their designs.

Accessibility affordances: Transparent Braille labels for physical pieces. Onscreen text will be read aloud automatically, with onscreen button to re-read. Audio feedback and sound effects.

Visitor experience

Step-by-step:

1. Visitors use touchscreen to choose one of three users, each with a specific goal (e.g., a wheelchair for the beach) and abilities. The user gives a brief personal background and description of his/her goal.

2. Animated instructions show visitors how to place wheelchair parts pieces in spaces designated. Visitors choose from a variety of wheelchair features (frames, wheels, seats, accessories).

3. Visitors press onscreen Test button and see an animation of the user testing the finished wheelchair in the goal scenario.

4. The user addresses visitors with feedback on what worked well or not, and encourages visitors to redesign the wheelchair. Consider including a sort of "satisfaction meter": "It could use a some tweaking," "It's working pretty well," "I love it!" *[NOTE - this user feedback and the user background description are THE POINT of this activity, so their commentary and feedback needs to be substantial - insightful, and sometimes surprising. I'm fine with a satisfaction meter as well, but that's just a quick metric or final "grade" that the user gives the design. This is the opportunity we have to have the visitor make design decisions that get vetted by a user of assistive tech, so the user feedback has got to be good. THOUGHT - could it be cost effective to script responses that maybe we get Elaine to read as the "user responses" via video? Yes, video is expensive, but so is illustration/ animation. - PM]*

5. Visitors press onscreen buttons to Redesign or Choose New User. Redesign button goes to the instruction/design screen. Choose New User button goes to Choose user screen.

Attracting Power					
Unique experience		Choice/multiple outcomes	x	Unique/real artifacts	
Challenging activity	x	Personalized experience		User created content	
Surprise/humor		Creative expression		Immersive design	
Inspires discussion		Uses smell/touch/sound	x	"Breaking" the rules	
Cooperative activity		Physical manipulation	x	Authentic context	
Problem-solving	x	Unique interface			

Universal Design Characteristics			
Easily navigable		**Touchable artifacts**	
Comfortable seating	x	**Tactile elements**	x
No flashing lights		**Audio**	x
ASL accompaniment		**User-controlled pace**	x
Instructions presented through pictures	x	**Controls operable with limited hand strength**	x
Multi-modal communication of main messages *(text, audio, imagery)*	x		

Girl-Inclusive Content		Girl-Inclusive Design Characteristics	
Empathetic message	x	Brightly-colored	
Altruistic aspect	x	Multi-user	
Multi-win	x	Collaborative	
Female role models		Off-stage area	

Family-Friendly Characteristics *(PISEC, 1998)*			
Multi-sided		Multi-modal	x
Multi-user		Readable (text arrangement)	x
Accessible (comfortable to children & adults)	x	**Relevant**	x
Multi-outcome	x		

Inclusivity in Imagery & Content	
Gender and ethnicity representation is intentional or representative	x
Depiction of age ranges is intentional or representative	x
Graphics and content do not reinforce stereotypes	x
Reflects individuals with different ability levels	x
Public health and safety is reflected in images	x

National Science & Engineering Standards	
Framework for K-12 Science Education Core Idea ETS1.A	x
Framework for K-12 Science Education Core Idea ETS1.B	x
Framework for K-12 Science Education Core Idea ETS1.C	x
Framework for K-12 Science Education Core Idea ETS2.A	
Framework for K-12 Science Education Core Idea ETS2.B	
National Science Education Standards, Content Standard E	x
National Science Education Standards, Content Standard F	x

Main Messages Supported
1
2
3
4
5

Example 3

Developer(s):	Vicki	**Designer(s):**	Syrrah (3d) Holly (2D)

#C01 *Boat Design*

Component Needs:

- 1 large water tank
- Timers (that respond to motion sensors?)
- 1 build station
- Chairs or stools (how many?)
- Graphic panels
- Copy and illustrations
- Boat materials (TBD)

Visitor Learning Goals

- What visitors do: Visitors design, build, and test designs for boats to navigate the Willamette.
- What visitors learn: Visitors learn about hull design. They also learn that the engineering process centers around who uses the products.
- What visitors feel: Friendly competitiveness. Creative challenge. Pride in their designs and a desire to keep tinkering.

Exhibit description

At a glance:

- There is a large water table designed to evoke a river setting.
- Above the water tables and build station are graphic panels explaining the design challenge.

Notes on Environment:

- The table evoke a scene on the Willamette.

Notes on Copy and Illustrations:

- Bilingual copy, heavily supported by illustrations.

Details to Nail Down:

- *Is the motion sensor/timer idea feasible?*
- *What will the weights look like?*

Visitor experience

Step-by-step, what the visitor does:

- Notices people testing boats, and walks to build station in search of materials.
- Looks to the graphic panels for instructions on how to build a boat. Builds a boat.
- Puts boat in the water table to see if it will float. Refines and tests design until it does.
- Adds “bells and whistles”: sails to make it move, perhaps extra hull pieces to carry more weight. Tests for speed and for how much weight the boat can carry, and iterates until satisfied with design.
- Shows off to friends, and perhaps engages in races or imaginative play.
- Inevitable unintended test: walks to wave tank and tests boat’s surfing ability. Crashes boat into another visitor’s tsunami shelter.

Why is this fun?

Visitors get to design, build, and test boats that actually move in water. Then they get to race and play with them!

How is it social?

Visitors gather around the table as they test boat designs. Graphic panels emphasize the people-centric aspects of the design process

How is it personally relevant?

Boats are fun and recognizable objects.

How is it altruistic?

People need boats for work and enjoyment. Engineers think about these needs when they design (emphasized in graphics)

How is it an engineering challenge?

Visitors engage in an iterative design process as they build and test their boats.

Example 4

04 Helmet Drop

At a glance: Visitors add inserts modeled after hedgehog quills, cat paw pads and pomelo rinds to a drawer to design a helmet that will protect a rider. After closing the drawer, visitors push a button and see a hammer fall on their design. Results are displayed on a screen.

Component Needs:

- Enclosed testing station with force plates and a hammer mechanism
- Monitor that displays the force measured by the force plates
- Drawer for holding materials that slides into the testing station
- Materials that mimic cat paws, the pomelo rind, and hedgehog quills
- Storage area for materials
- Text panels and labels
- Seating
- A surface to build on

Target Audiences: Girls age 9-14 and their families

Visitor Learning Goals *(Visitors do/learn/feel…)*

1. Visitors do:
   - design, build, and test a biomimetic helmet liner
   - try to create a design that meets criteria (resisting specified amounts of force)
   - empathize with the narrator
2. Visitors learn:
   - different ways force can be dissipated
   - nature has many ways to protect from physical trauma
3. Visitors feel:
   - inspired
   - challenged
   - successful

Exhibit Component Type					
Mechanical	☐	Software	☐	Full body	☐
Computer	☐	Video	☐	Multi-user	☐
Electronics	☐	Audio	☐	Graphic Panel	☐
Immersive	☐	Collaborative	☐	Digital Readout	☐

Visitor experience

Step-by-step:

1. Visitors approach the station and try making an effective helmet liner
2. Visitors layer materials into a drawer that slides into the testing area. Pressing a button drops a hammer into the design.
3. A digital readout tells visitors how effective their design is
4. Visitors can iterate and modify their designs. Inspiration can come from the text panels
5. Visitors test their designs iteratively until they reach a desired or specified effectiveness

Notes on function (what should it do? how do we think it will do that? what are the indicators of success?):

- inserts should be easily distinguishable from each other, easy to put into the drawer
- test station should be safe and intuitive to use
- digital readout shows force of impact - should have a range indicating acceptable forces

Accessibility Considerations: audio description, wheelchair access - materials and testing area reachable by all visitors

Family-friendly considerations:

- space for multiple people to work on designs at the same time.

Notes (on Environment, Copy and Visual Content)

-

Items to Nail Down:

- material options

Main Messages supported:

Principles from nature help wildlife thrive, and can provide solutions for the problems we face.

- Nature has efficient solutions that work in interconnected systems.
- Inspiration from nature is all around us.
- Learning from nature will contribute to a more sustainable future for us all.

Engineering is a problem-solving process; it's creative, collaborative and can be used in your everyday life.

- **Biomimicry is an approach to engineering.**
- Part of the design process is considering constraints on and impacts of your design.
- **I can connect biomimicry solutions to the problems in my own community.**

We can use biomimicry to engineer solutions that model and respect nature

- Biomimetic designs can contribute to a more sustainable future.
- Using nature as a constraint leads to designs that support sustainable thinking.

Example 5

03 Kinetic Kites

At a glance: A table provides a variety of materials to design a kite that will pull to generate electricity so that a girl living on a southeast Asian island can charge her phone. Visitors connect their design to a test station to see how much lift it generates.

Component Needs:

- blowers with attachment point for testing
- building materials
- material storage
- build area
- force meter
- digital readout
- copy panels
- narrative panel

Target Audiences: Girls age 9-14 and their families

Visitor Learning Goals *(Visitors do/learn/feel…)*

1. Visitors do:
   - design, build and test a kite design that generates lift
   - try to create a design that meets criteria for energy generation
   - empathize with the narrator
2. Visitors learn:
   - kites can generate electricity
   - nature has many examples of things that float and glide
3. Visitors feel:
   - inspired
   - challenged
   - confident
   - successful

Exhibit Component Type					
Mechanical	☐	Software	☐	Full body	☐
Computer	☐	Video	☐	Multi-user	☐
Electronics	☐	Audio	☐	Graphic Panel	☐
Immersive	☐	Collaborative	☐	Digital Readout	☐

Visitor experience

Step-by-step:

1. A text panel introduces a girl who lives on a southeast asian island where there is a lot of wind, but electricity is expensive. She challenges visitors to design a kite that will generate the power she needs.
2. Visitors use materials (paper, pipe cleaners, etc.) to create a design that will generate lift
3. visitors can test and iterate their design in a vertical wind tube
4. visitors attach their design to the testing guide and turn on the wind
5. Digital readouts show how much lift the design generates

Accessibility Considerations:

- materials and attachment reachable by someone in a wheelchair
- audio feedback in addition to digital readout
- attachment should not require too fine motor skills

Family-friendly considerations:

- space for multiple people to wok on designs at once
- results visible from a distance
- familiar materials

Items to Nail Down:

- Consumable or reusable materials?
- One or two wind tubes?

Main Messages supported:

Principles from nature help wildlife thrive, and can provide solutions for the problems we face.

- Nature has efficient solutions that work in interconnected systems.
- Inspiration from nature is all around us.
- Learning from nature will contribute to a more sustainable future for us all.

Engineering is a problem-solving process; it's creative, collaborative and can be used in your everyday life.

- **Biomimicry is an approach to engineering.**
- Part of the design process is considering constraints on and impacts of your design.
- **I can connect biomimicry solutions to the problems in my own community.**

We can use biomimicry to engineer solutions that model and respect nature

- Biomimetic designs can contribute to a more sustainable future.
- Using nature as a constraint leads to designs that support sustainable thinking.