THE LEMELSON CENTER FOR THE STUDY OF INVENTION AND INNOVATION

Smithsonian

Inventive Identity Toolkit

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This toolkit is intended for informal science learning (ISL) professionals who wish to help visitors see themselves as inventive problem solvers

I. What is inventive identity?

II. Designing for inventive identity in ISL contexts

III. Real world applications

IV. Inventive Identity Facilitation Toolkit

V. Appendix

I. What is inventive identity?

Inventive identity: a person's network of inventive-related beliefs, goals, self-perceptions, emotions, and possible actions oriented toward creative solutions for complex problems

The Dynamic Systems Model of Role Identity (DSMRI)
Kaplan & Garner (2017)

People have multiple role identities (sister, student, athlete). When they attend an ISL site, the most salient role identity may be visitor. How can we help them connect what they learn to other roles in their life?

We use the DSMRI to conceptualize inventive identity. The DSMRI is a theoretical model that integrates learning, motivation, and action, to explain how a person's role identity frames their experiences, decisions, and actions in a particular situation and role.

According to the DSMRI, components interact to shape role identity expression and change

Component	Definition	Example
Role identity	A contextualized and dynamic network of beliefs, goals, self-perceptions, possible actions, and emotions that a person has when occupying a role in the world	A museum visitor, a parent, an educator.
Self-perceptions	The way the individual describes their own characteristics, traits, interests, and tendencies	A visitor describes themselves as "a life-long learner."
Ontological and Epistemological beliefs	Beliefs about the nature of reality – of people, situations, cause-and-effect relations. Beliefs about one's knowledge, its certainty and complexity, and how it changes or is acquired.	A visitor believes that the ISL space is safe, and that the purpose of the activities is to have fun. A person's sense of uncertainty about what is happening.
Purpose & Goals	The intended ends that an individual is striving to achieve while in a particular role.	A visitor intends to draw an idea for an invention.
Perceived Action Possibilities	Mental, speech, and/or behavioral actions that an individual considers to be possible when inhabiting a role.	Perceiving that an activity can be engaged with or an inventive strategy can be carried out.
Emotion	Feelings or affect.	A visitor feels excited, or anxious.
Dispositions	Relatively stable temperament or personality characteristics.	Introversion, openness to experience, tolerance of ambiguity.
Social context	The immediate interpersonal, physical, and cultural setting of activities and experiences.	The interpersonal, physical and cultural features of an ISL space in a museum.
Domain	A life domain within a culture (e.g. school) and a subject domain within those (e.g. science) that circumscribes the cultural meanings relevant to framing the role identity. Domains have their own cultural characteristics (e.g. what is considered a means of inquiry).	Science, history, etc. can inform the content of a role identity that we have, such as knowing, believing, and perceiving, and acting as a scientist or inventor.
Culture	The network of meanings about life and the physical and conceptual artifacts that capture those meanings that are shared among people belonging to a particular group.	The meanings of a traditional wedding ritual for a particular ethnic group; the meanings of attending a museum for people from a particular geographic, ethnic, and socioeconomic group.
Action	Speech and/or behavioral action that expresses and provides an input to a person's role identity in a particular situation.	A visitor selects and combines materials to make a prototype invention; a visitor views and reads the labels in an exhibit.

There are many verbal indicators of inventive identity

Agency and self-efficacy for invention: Inventive self-perceptions and self-definitions
“I am an inventor”
”Look what I invented”
”I can do this…”

Orienting to creating solutions to prescribed and self identified-problems: Inventive goals
”I want to…”
”I am trying to… ”

Articulating/Identifying a problem to solve: Inventive beliefs, self-perceptions, and goals
”Let’s make …. better/different”
”Something that always bugs me is…”
”Did you ever notice that…”

Developing a creative solution to a challenge or problem: Inventive beliefs, self-perceptions, goals, and actions
”I know… let’s…. ”
”If we …. Then….”
”I know what we can do…” [describes solution idea]
”I have an idea”
”This can be made/done better”
“Asking other inventors: ”Can I try something (help)?”
”What if… (some sort of solution)?”

Designing with empathy, demonstrating empathy, problem solving with a user in mind: Inventive beliefs, goals, emotions, and actions
”I made this for [insert audience]”
”I am inventing this for my mom because she always…. ”
”This will help [Insert audience]”

Ascribing personal ideas, values and experience to solving a specific problem: Inventive beliefs, self-perceptions, and actions
”If we solve this, then… [describes future state]”
”I’ve done something like this before… ”
”I once had a similar situation…”

Actualization that their activities/behaviors are inventive: Inventive beliefs and self-perceptions
”… new idea…”
”I just made it up…”
”Never have seen anything like that/this…”

Functional descriptions, using imagination to assign meaning to materials: Inventive beliefs
“this piece here is the exhaust pipe so that it doesn’t get smoky inside when you turn on the machine…”

There are many verbal indicators of inventive identity

Recognizing a shared identity with someone represented in the space: Ontological beliefs and self-perceptions
"A seven-year-old invented that? I'm seven…"
"Kids made all these inventions?"

Sharing their invention/product with other people: Self-perceptions, goals, and action possibilities
"Look what I did…"
"That's mine…"

Visitors coaching other visitors
"Here's what we have to do here…"
"It's like when we… but now we have to…"
"I can help you…"

Verbalizing process
Narrating what they are doing: "Now I'm…"
Visitors asking one another questions: "So, why did you add that on?"

Continuing to try solving a problem even after setbacks and failure
Resilience – "Let's try again…"
Curiosity – "I wonder what would happen if…"
Collaboration – "Maybe try this…" "That's a good idea, let's do that…"

Other expressions indicative of inventive identity
"I can't leave right now, I am working on my invention…"
"I am going to keep working on this invention at home"
"I need this piece in order for [this thing] to happen"
"I need something that looks a little bit like this but has [insert different characteristic]"
"Oh! This is just what I need"
"There it is!"
"What if we did this instead…"
"I like to make stuff"
"Can I help?:
"If we try this, we might be able to…"

Successfully outlining an outcome and then making that happen
Verbal/action combination

There are many behavioral indicators of inventive identity

Decision to engage in the process of invention, showing conscious choice and intention to invent
Spark of self-awareness and goal-oriented body language
Facial expressions
Body positioning related to invention activity or content
Open / eager
Considering options
Contemplative (taking it all in)
Excited (looks around / moves around the materials)
Curious

Actions that indicate emotional involvement in the process at hand
Sparkle in the eye…

Seeking solutions through exploration of content or materials
Considering/testing/exploring materials for the purpose of problem-solving (not as end in itself)

Searching for materials that will help the visitor work through their process to meet the suggested or self-defined end
Reaching for and considering materials
Connecting / disconnecting materials, exploring components and combinations

After engagement in invention-based content there is a self-selecting choice to engage in other invention-based content of different scope or context (e.g. invention challenge in a different content domain)

Demonstrating sustained focus and confidence… iterating inventions… showing that they have tweaked their inventions in response to testing / trying it out

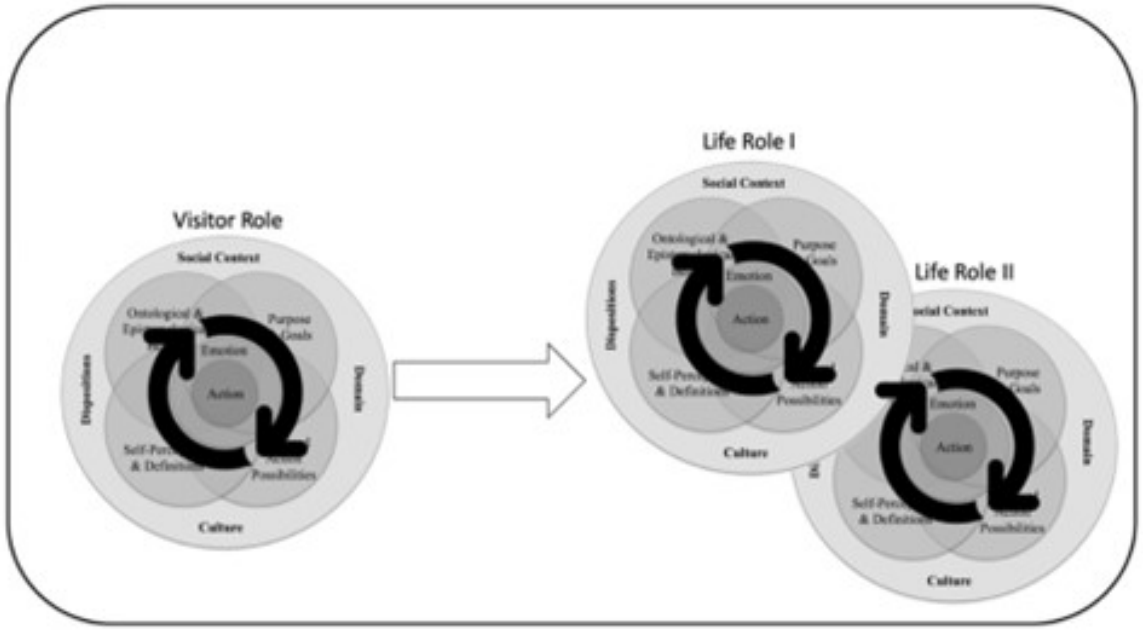
Moving past frustration, pivoting from frustration to engagement

Experiences the block or surprise of "failure" but not giving up, remaining in a curious mode

Experience makes the process easier… the inventive process can be improved through practice

Visitors find challenges easier after they have already worked on a different activity in the space.. They start to "get" the process itself

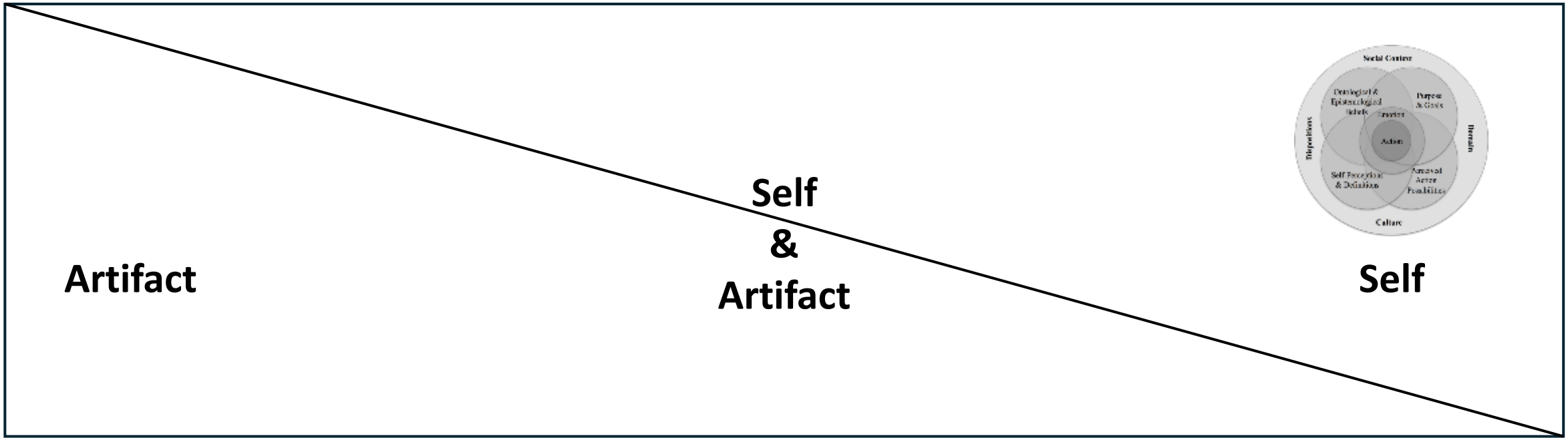
Identity exploration involves seeking and processing information and experiences in relation to the self for self-knowledge, growth, decision making, and action



In ISL environments such as Spark!Lab at the National Museum of American History (above left), visitors practice inventive strategies in a context that promotes the development of an inventor role identity, and the transfer of inventive identity components to other, everyday role identities (above, right).

II. Designing for inventive identity in ISL contexts

Exhibition design strategies can prompt visitor engagement towards identity exploration



Visitor Identification and Engagement with STEM (VINES)
Garner, Kaplan & Pugh (2016)

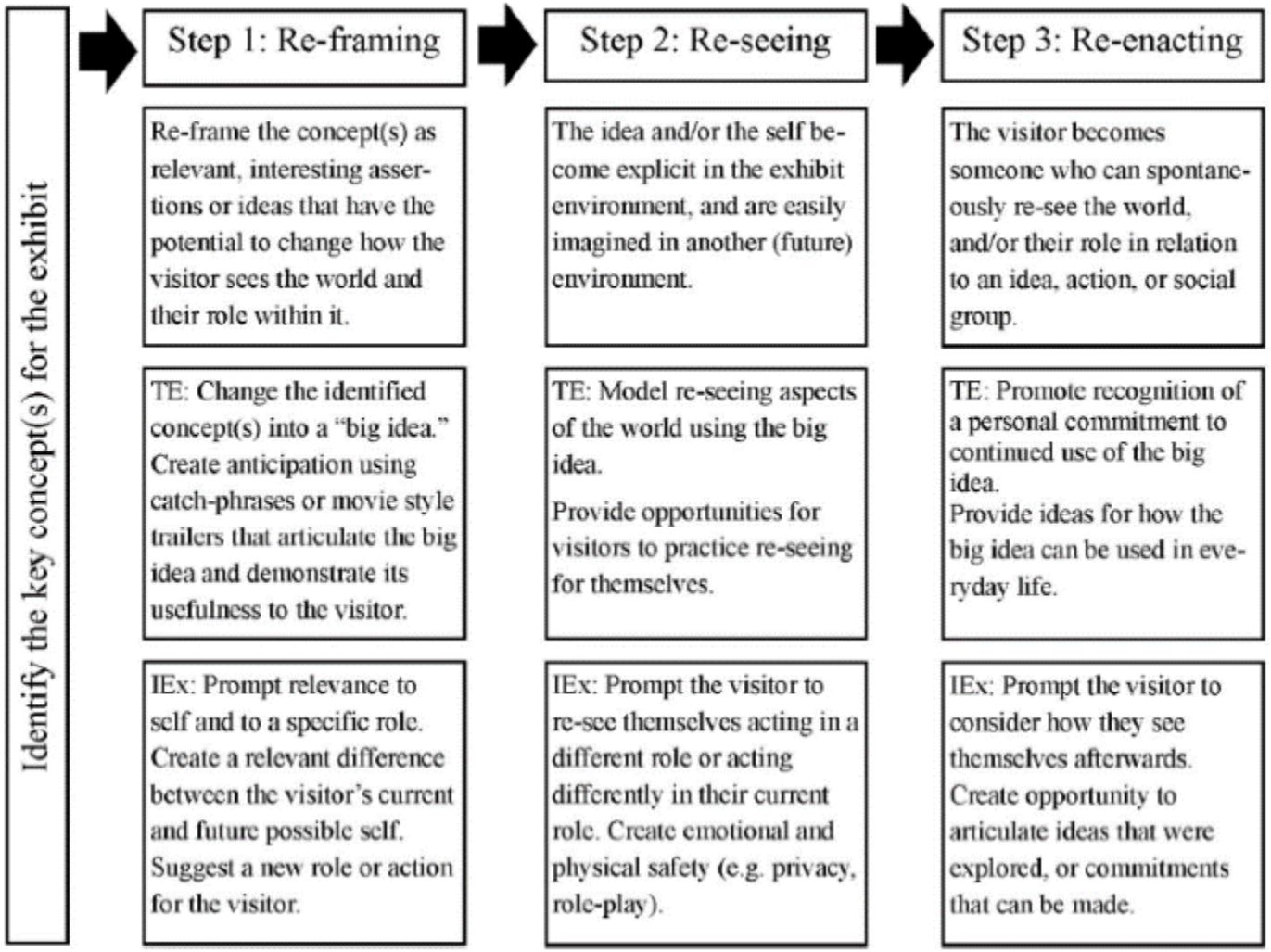
The left side of the continuum reflects visitor engagement that is targeted towards understanding of an object, artifact, or phenomenon, and does not explicitly include the self. In the middle lie transformative experiences, involving engagement that references self and artifact. Here, the individual is scaffolded to meaningfully "re-see" the world in service of self-relevant, personal growth-oriented activities. The right side reflects engagement that is targeted towards the self and one's beliefs, assumptions, goals, and courses of action, and minimizes learning about an artifact for its own sake.

The VINES framework offers strategies for moving engagement across the continuum

1. Re-frame concepts into big ideas and help the visitor find ways to make the idea relevant to their own actions.

2. Re-see the world using these ideas; help the visitor imagine themselves acting differently.

3. Support the visitor to re-enact the big idea or new behaviors and reflect on how it went.



Visitor Identification and Engagement with STEM (VINES)
Garner, Kaplan & Pugh (2016)

When designing for identity exploration, consider cognitive, emotional, social-developmental, and cultural aspects of the visitors' lived experiences

People vary in their developmental readiness and motivation to engage in identity exploration: Some individuals more readily explore their identity, while others require scaffolding and support to initiate or sustain exploration. Even individuals who readily engage in identity exploration may not do so constructively, consistently across contexts, or in ways that align with educational goals—in the current case, exploring their inventive identity. Thus, contexts need to incorporate scaffolds for identity exploration that consider developmental, cultural, and individual differences relevant to identity exploration, aiming to be as inclusive as possible of such diversity.

Cognitive developmental capacities: Before early adolescence, children commonly have limited capacities in abstract cognition, metacognition, self-reflection, and future orientation. Therefore, they require significant scaffolding to engage even in nascent identity exploration, and such exploration is likely to focus on concrete experiences in the present or very near future. In comparison, adolescents and adults commonly possess these capacities yet may vary in the propensity to engage in identity exploration, and in the identity exploration foci and strategies. Thus, even adults require scaffolding to initiate and align identity exploration with a context's educational goals.

Emotional developmental capacities: Corresponding with cognitive developmental capacities, young children, but also older people who experience emotional challenges, may struggle to explore their emotional experiences, and would require explicit scaffolds to do so. Older adults are commonly more adept at reflecting on, regulating, and processing complex emotions. However, they too may benefit from supportive scaffolds that enhance sense of emotional safety to explore the implications of emotional experiences to their identity.

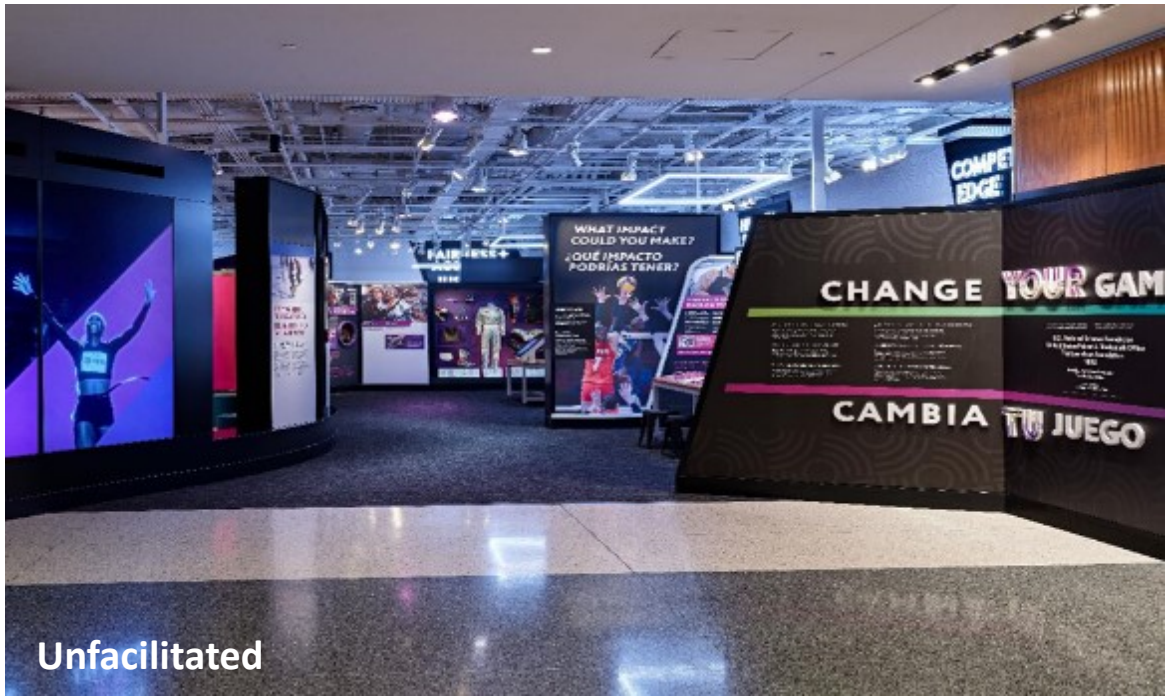
When designing for identity exploration, consider cognitive, emotional, social-developmental, and cultural aspects of the visitors' lived experiences

Social developmental capacities: Young children primarily construct their identity through social interaction with significant adults, primarily their caregivers, and their identities reflect the values and characteristics of those adults. Scaffolding nascent identity exploration among such young children needs to be structured and consider their familiar people and social contexts. In comparison, adolescents require autonomy to engage in identity exploration and are more peer-focused. They may be more likely to engage in identity exploration if their peers are supportive of such engagement and if structures provide them with opportunities for self-direction. Adults also rely on social contexts and interactions for identity exploration, with more socially adept individuals, and individuals who are members of communities that endorse and scaffold identity exploration, more likely to engage. Across developmental stages, contexts should harness social interactions to scaffold identity exploration, and structure scaffolds to be inclusive of developmental differences.

Cultural characteristics: Identity exploration is a cultural activity; it is framed and guided by cultural notions of self, cultural values and goals, and cultural ways of reflecting, experimenting with alternative selves, and interacting with others. Cultural groups differ in their endorsement of identity exploration and in their sanctioning different boundaries for identity exploration. Scaffolds should be inclusive, offering multiple contents, experiences, and alternative strategies to initiative and engage in identity exploration that cater to diverse cultural readiness and identity exploration modes.

III. Real world applications

We have applied the design principles and elements used to scaffold inventive identity exploration in an unfacilitated exhibition gallery and a facilitated invention education space



Unfacilitated

Facilitated

Change Your Game | Cambia tu juego is a 3,500 square foot, bilingual exhibition at the National Museum of American History in Washington, DC. Using over 60 objects from the Museum's collection and presenting the stories of diverse inventors in the domains of sports and technology, Change Your Game invites visitors to identify themselves as inventive problem solvers who can become "game changers" in their daily lives.

Draper Spark!Lab is the flagship educational initiative of the Lemelson Center for the Study of Invention and Innovation. Spark!Lab is where museum visitors become inventors. Activities incorporate science, technology, engineering, and math (STEM) with art and creativity. The Spark!Lab Network takes this unique approach to hands-on learning beyond the Smithsonian and into educational and cultural organizations across the United States and beyond.

Change Your Game | Cambia tu juego is a 3,500 square foot, bilingual, family-friendly exhibition at the National Museum of American History in Washington, DC

The Starting Line entrance to the gallery

Health and Safety motivation zone

Fun for Everyone motivation zone

The exhibition features over 60 objects from the national collection across six zones: a Starting Line that introduces the exhibition, four Motivation Zones, each highlighting a core inspiration for invention in sports—achieving a Competitive Edge, promoting Health and Safety, facilitating Fairness and Accuracy in officiating, and enhancing the Fun and Accessibility of sports to diverse participants—and finally, an End Zone where visitors can explore their own inventive creativity. Several hands-on, interactive activities challenge visitors to engage directly in the inventive process while considering the broader impacts of their actions both inside and outside sports. Visitors are encouraged to see themselves as inventive problem solvers who can become "game changers" in their everyday lives.

In Change Your Game, inventive motivations are re-framed as big ideas, inventors are re-seen as everyday people, and interactives allow re-enactment of inventive behaviors

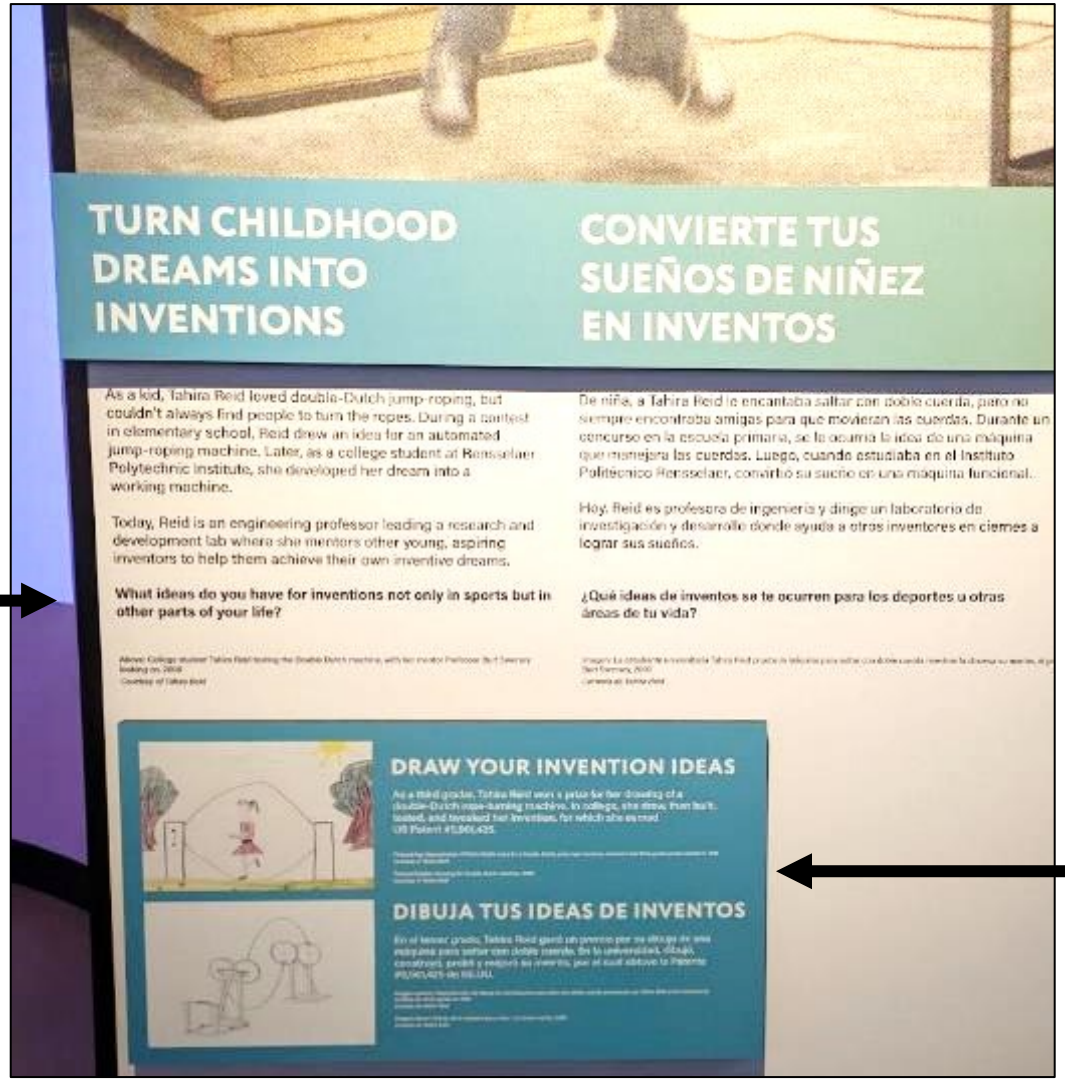
RE-FRAME: The Competitive Edge zone presents the inventive motivation to win as a big idea and asks the visitor “What impact could you make?”

RE-SEE: Shawn Springs, former NFL player, is a featured inventive person who was inspired to create safety equipment because of his own experiences.

RE-ENACT: Visitors can practice the inventive strategy of testing and tweaking when they use this interactive to design and race a swimsuit.

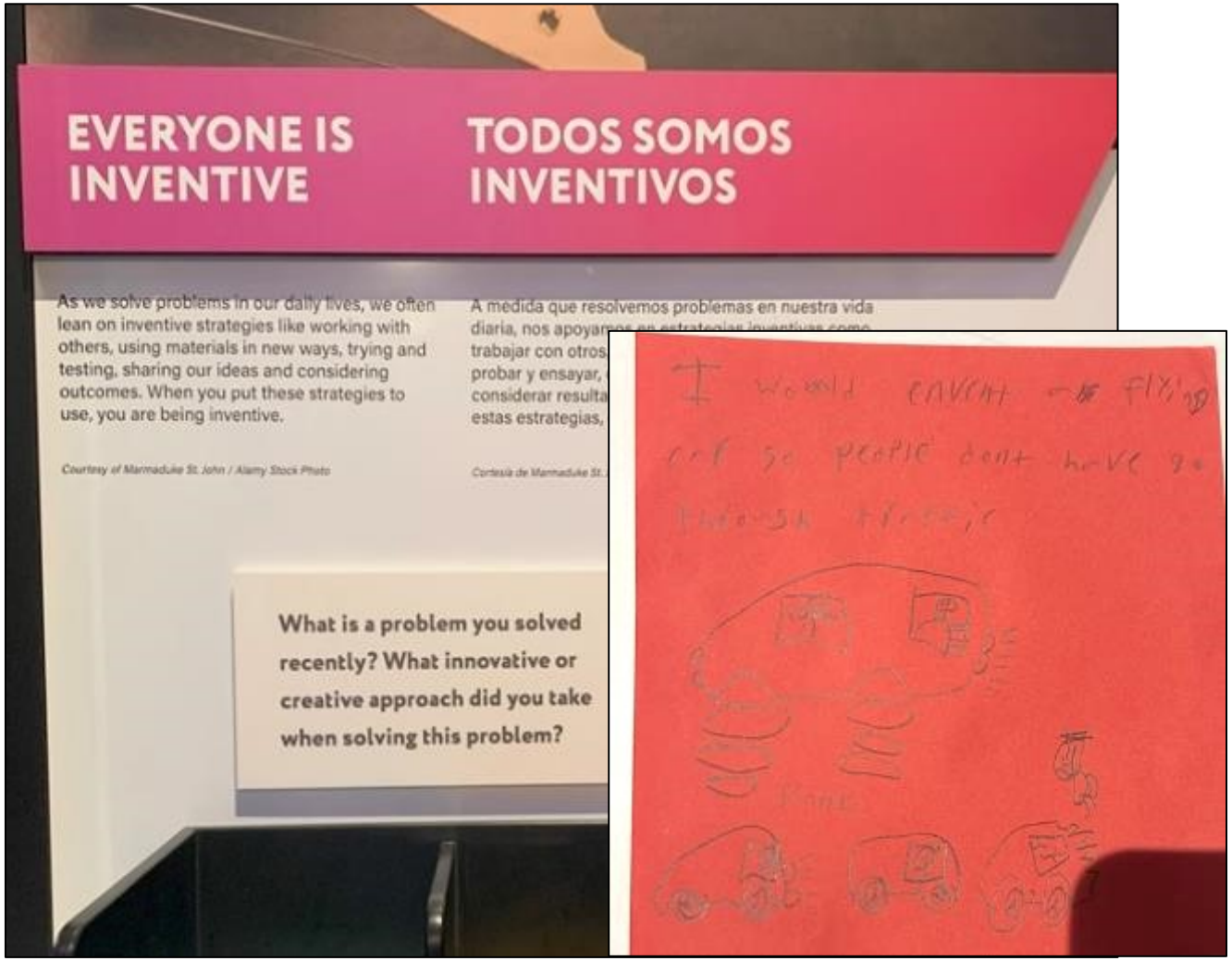
Including inventive identity language in the label text of Change Your Game turns inventors' goals and strategies into a call to action for visitors

The Fun for Everyone motivation zone features a "jump-rope" machine dreamed up in childhood by engineering professor and inventor Tahira Reid. The label text ends with a question for the visitor: "What ideas do you have for inventions not only in sports but in other parts of your life?"



The label text introduces the inventive strategy of drawing ideas.

In the End Zone, the What Will You Invent? interactive invites visitors to sketch their inventions and a curated selection of drawings are displayed for others to see



The What Will You Invent? interactive includes prompts such as “What is a problem you are passionate about?” and “What is a problem you solved recently?” One visitor responded, “I would invent a flying car so people don’t have [to] go through traffic.”

In the Safety Remix interactive, visitors think like an inventor by considering task constraints and striking a balance between safety and performance

An animated sequence shows success or failure depending on the visitor's choices

The Be a Game Changer interactive invites the visitor to create an inventive self-portrait by selecting preferred roles, domains, purposes and goals, and strategies for being inventive

The activity station asks visitors to think about activities that represent things they do every day that are inventive, e.g., playing, exercising, cooking, helping. Then it asks about roles visitors identify with: do you consider yourself a worker, a team member, a leader, an advocate? Finally, it asks visitors to consider their inventive strategies and how they like to get things done: By teambuilding? By imagining? By problem finding? By innovating? The interactive reminds visitors that "The things that you do every day are inventive" then presents a screen titled "Inventive Me" surrounded by a word cloud consisting of the different activities, roles, and strategies that the visitor self-selected on the earlier screens.

The Spark!Lab Network takes a facilitated, hands-on approach to learning and invites children and families to invent together

The Spark!Lab Network includes Draper Spark!Lab at the National Museum of American History in Washington, DC, and additional sites.

Spark!Lab Facilitators help visitors explore their inventive identities

Spark!Lab Facilitators collaborated with researchers to create and implement an Inventive Identity Facilitation Toolkit. The Toolkit is designed to be used flexibly to support visitors' engagement with inventive activities and promote recognition that everyone can be inventive in everyday life roles.

IV. Inventive Identity Facilitation Toolkit

Meet the Tools

- **Observe** 
  - *Observe, assess, facilitate*
- **Confer** 
  - *Use the language of invention*
- **Reinforce** 
  - *Reinforcing process/product*
- **Invite** 
  - *Prompting visitors to "Share It"*
- **Encourage** 
  - *Provide encouragement*
- **Welcome** 
  - *Facilitating comfort in the space*
- **Motivate** 
  - *Prompt inventive thinking beyond the Spark!Lab context*
- **Scaffold** 
  - *Make the learning experience fit the visitor*
- **Enhance** 
  - *Get silly, challenge them*
- **Collaborate** 
  - *Work together towards their goal*

Tool Breakdown

OBSERVE:
Observe, Assess, Facilitate

The types of questions asked can help lead visitors towards an outcome without giving them the "right" answer right away.

Observe, then ask leading questions to prompt further observation and exploration.

"Let them explore first!
(Then help them if they are stuck)"

"I asked him to observe"

It's important to allow the visitor to explore options/action possibilities themselves rather than beginning the interaction by pointing out the "correct" answer

Tool Breakdown

CONFER:
Use the language of invention

Using inventive language in questions, affirmation, and conversation with visitors, reinforces their identity as inventors.

Directly relate what they are doing to invention.

"You just invented something"

"Let's see your prototype"

By using the language of invention to address actions a visitor is taking, you are assigning them the role of inventor and allowing them the opportunity to accept and embody that role.

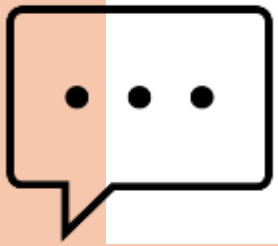
CONFER:
Use the language of invention

- What are you **inventing?**
- You're doing just what an **inventor** does!
- **Inventors** often have trouble at first too, but they keep trying until they find a solution. You can do it!
- That's really **inventive!**
- Tell me about the **process** you used to create your **invention**.
- I really like that you **sketched** your idea first. **Inventors** often do that to get ideas from their heads into reality.

CONFER:
Use the language of invention

Start with a question…

- Why…?
- What is the purpose of…?
- What if…?
- How would it be different if…?
- How did you…?
- Who might use…?
- What would change if…?
- How else could…?



…and add the language of invention

- Invent / Invention / Inventor
- Explore
- Notice
- Problem / Challenge
- Materials
- Prototype
- Test
- Tweak / Change
- Collaborate

Tool Breakdown

REINFORCE:
Reinforcing process/product

It's important to reaffirm that whether or not a visitor has achieved the specific goal they wanted, they are still an inventor because they engaged in the invention process.

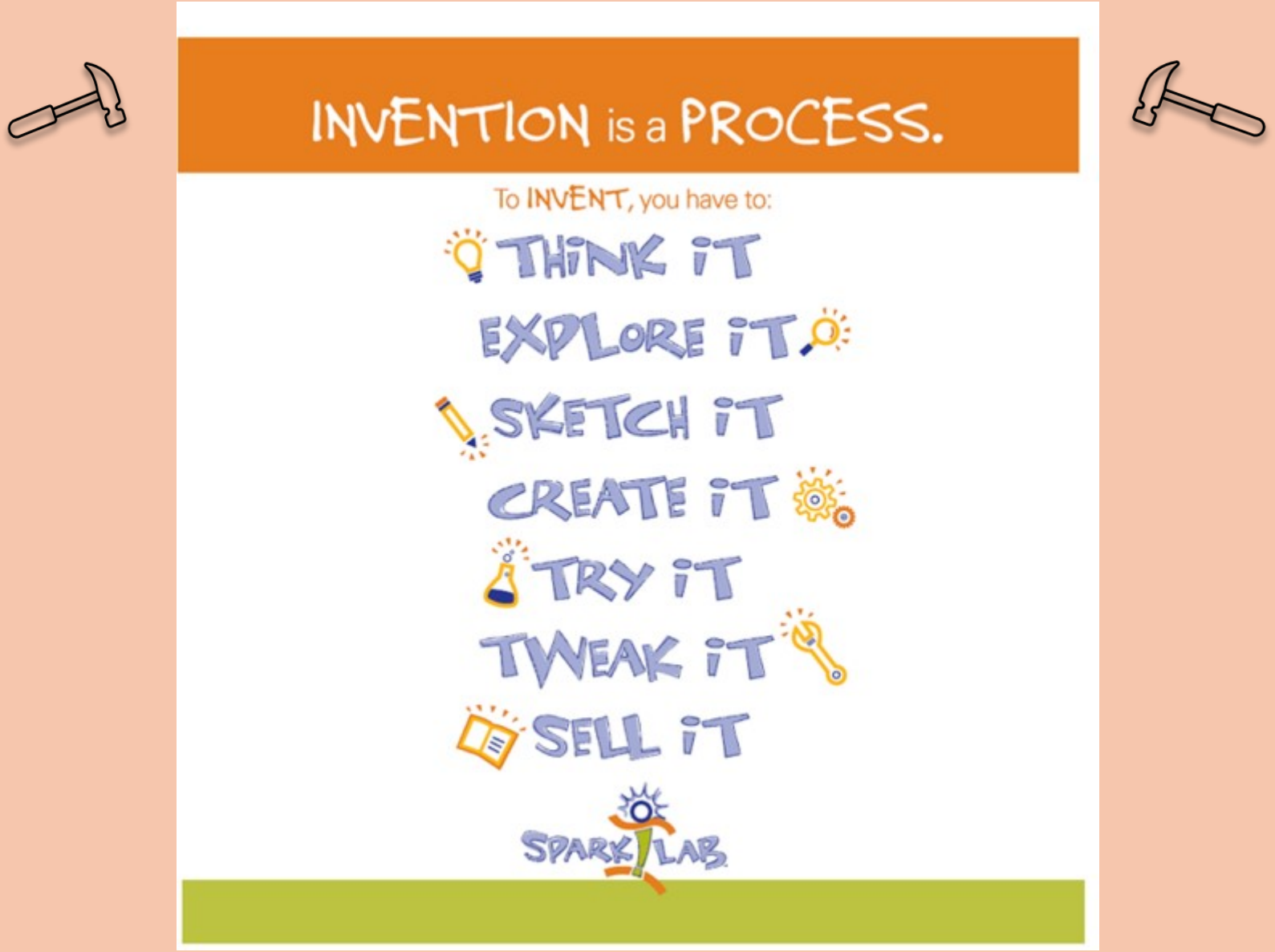
Allow the visitor to explore options/action possibilities themselves rather than beginning the interaction by pointing out the "right" answer; give permission for them to explore their own inventive identity, not fit into one they think they think is "correct".

"I tell them that there may be a 'usual' way someone approaches playing at one of the stations, but they are free to do something different."

"there's no right or wrong answer"

This concept can be uncomfortable to some visitors - helping them understand this through facilitation is so important.

At Spark!Lab, we help visitors understand that invention is a process



Tool Breakdown

INVITE:
Prompting visitors to "share it"

Take their experience with the invention process to the next level by prompting them to explain their process.

This gives visitors an opportunity to share their invention and verbally explain what they have made.

"I enjoy talking to the children about their inventions— hearing about what it is (what they call it), what it does, and why they chose to make it."
"ask open ended questions ...guide the experience...be a coach"

This step often opens the door for further questions/invention opportunities and the opportunity to reinforce their feeling of accomplishment and inventiveness (e.g. "what a great invention!")

Tool Breakdown

ENCOURAGE:
Provide encouragement

Directly relate what the visitor is doing to invention through providing praise and/or lifting them out of frustration.

"I celebrated with him/ he was pleased to see my joy in his accomplishment"

"I told the girl that she is an excellent engineer"

Don't assume that because a visitor is "succeeding" at an activity that they can't benefit from facilitation; providing encouragement at any stage in the invention process actualizes their actions.

Tool Breakdown

WELCOME:
Facilitate comfort in the space

As facilitators we must do our best to break through barriers that may be preventing visitors from feeling safe to explore their identity within the space.

Everyone is inventive in Spark!Lab; traversable obstacles shouldn't prevent this.

"Through [using] her dad as a translator, we explored"

Use family members, other staff members, or google translate to help overcome language barriers.
Try providing sensory resources and being open to accommodations for neurodivergent visitors.

What other barriers and strategies have you encountered?

Tool Breakdown

MOTIVATE:
Prompt inventive thinking beyond the Spark!Lab context

Doing so will help visitors think about invention beyond the space and to connect inventiveness to their own lives.

"At the door, I would tell inventors 'invention just started here but it doesn't stop' "

Try asking: "What sort of inventing do you do at home?"
"Have you ever seen or done something like this before?"
"What will you invent next?"

Tool Breakdown

SCAFFOLD:
Change the experience to fit the visitor

Assess what the visitor already knows or has already explored before facilitation has begun, then meet them at that level and guide the experience from there.

"introduced items from another activity to prompt further testing and tweaking"

"began exploration of the activity by just plugging in cords, started on a smaller, more manageable scale"

Facilitators can create new challenges that "boil down" or "build up" the core activity in order to fit the visitors' needs.

Tool Breakdown

ENHANCE:
Get silly, challenge them

Piquing their imagination and creating scenarios that may or may not be plausible can get visitors thinking about different possibilities, warming up their minds to be more receptive to inventiveness.

"I interacted with the girl by asking silly questions related to the projects she was working on- like, opposite of what it was supposed to do or “was there a cat in it?”- just really unusual things. Really encouraged her to explain how it really worked."

Open their mind to the seemingly impossible made possible by creatively thinking outside of the box.

Tool Breakdown

COLLABORATE:
Work together towards their goal

Join the visitor in exploring the invention process while taking on the role of their invention assistant, working with them towards their goal and providing guidance when necessary.

"guided both teams to work together to create one invention to solve both of their problems"

Facilitators can implement this tool themselves or assign it to other visitors such as accompanying adults who may otherwise feel left out of the invention experience.

Facilitators model the tools for and with different kinds of visitors

In Spark!Lab, shifting facilitation tactics has been shown to foster richer inventive identity exploration. By implementing these tools and practicing those that fit best in a given interaction, facilitators can elevate a visitor's experience from a normal interaction to one centered around identity exploration. Not all tools work for all visitors; visitors may require more or less facilitation based on their preexisting perception of their role identity within the world of invention. Facilitators can foster a safe environment for visitors to explore their inventive identity and take what they have learned in the space out into the world.

The Inventive Identity Facilitation Toolkit has been disseminated to Spark!Lab Network sites

How was the toolkit shared with Spark!Lab Network Sites?

In November 2024, the Lemelson Center invited two representatives from each of the Spark!Lab Network sites to the Spark!Lab in Washington, DC to learn about facilitation through the lens of identity exploration. The conference attendees began with an introduction to the DSMRI theory that informed the creation of the toolkit, followed by a formal presentation of the tools, their significance, and how to apply them to individual museum spaces.

We held a group discussion following the initial introduction of the toolkit. The 45-minute discussion proved useful as network sites brainstormed how to tailor the toolkit to their Spark!Lab, their staff, and their museums at large. We held two additional discussions specifically centered around toolkit application within network spaces. The first discussion was a problem-solving session focused on implementing the toolkit in each museum's specific physical Spark!Lab spaces; we considered the benefits and challenges that could present. The second discussion focused on toolkit application for specific hands-on activities and visitors; this is where we introduced a toolkit-based train-the trainer game/activity.

The game was presented as an approachable way to learn/teach the toolkit. Attendees were asked to navigate scenarios with hypothetical visitors through the implementation of the toolkit's tools while using a set of common language vocabulary words to explain why the player would use a specific tool in a specific situation.

The Inventive Identity Facilitation Toolkit has been disseminated to Spark!Lab Network sites

Can the toolkit be tailored to fit other sites?

After learning about the Inventive Identity Toolkit and its application at the Spark!Lab Network Conference, a Museum Education Coordinator returned home to a Spark!Lab Network site and immediately set out to train museum staff (general educators) on the concepts in the toolkit. "I explained that these tools put words to the things that the team is likely already doing. Having appropriate/uniform language is necessary when communicating and learning!"

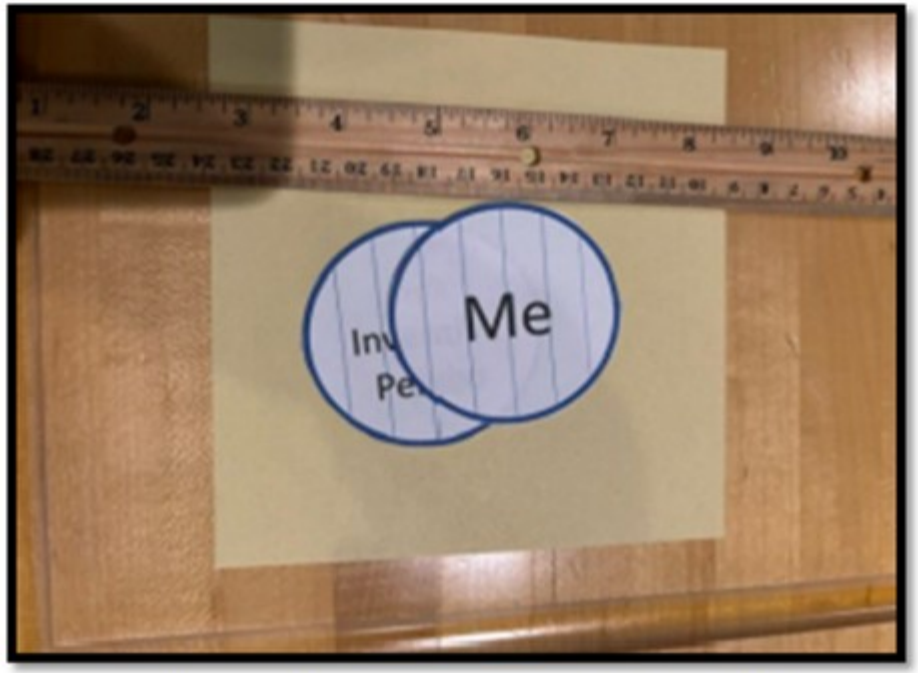
Where the original toolkit was created with inventiveness and Spark!Lab in mind, the toolkit itself is malleable enough to be applied to many different situations and museum settings. The coordinator remarked, "I did change a couple of the wordings to fit more in line with facilitation within the entire museum rather than just Spark!Lab. For example, for Confer, rather than 'Use the language of invention' I altered it to 'Use the language of discovery'."

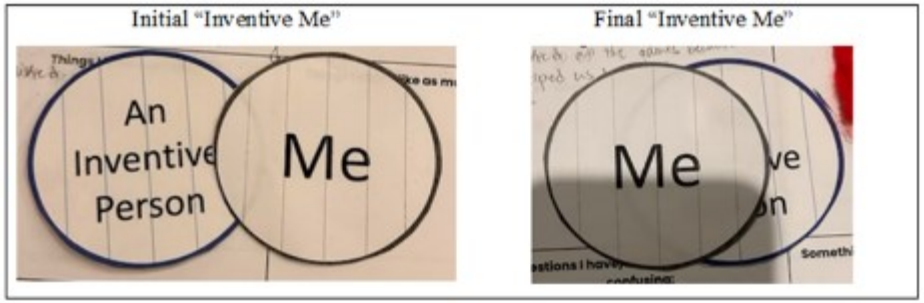
The coordinator facilitated a training exercise with staff, patterned after a game we played at the network conference (see Appendix documents v and vi). She separated educators into groups to consider how to apply the tools to different facilitation scenarios. "This got the educators to explain what they were thinking and often, how they would do it in real life. It also allowed me to make corrections/suggestions if the tool they chose was not quite what they were describing..."

V. Appendix

Appendix contents

Appendix i. “Inventive Me” is a measure that can be used before and after engagement.





Print two circles that say, “Inventive Person” and “Me.”

Ask the visitor: “Can you use these circles to show how you think of yourself compared to an inventive person? If you think you are very much like an inventive person, overlap the circles. If you do not think you are like an inventive person, do not overlap them. You can choose how much to overlap them.”

After engagement: “Would you like to change your circles? Can you tell me why you changed them/did not change them?”

Quantitative data: the degree of overlap (e.g. 25%, 50%) or use a ruler to identify change using metric numbers (e.g. a 5cm increase in overlap)

Qualitative data: the visitor’s explanation.

Appendix ii. “Facilitation Reflection” – a handy outline for recording facilitations

Appendix iii. “Meaningful Moments” – how Spark!Lab facilitators honed their inventive identity facilitation tools

Spark!Lab facilitators and volunteers collected and analyzed “meaningful moments” – recollections of interactions in which they perceived they had helped the visitor engage in inventive identity exploration.

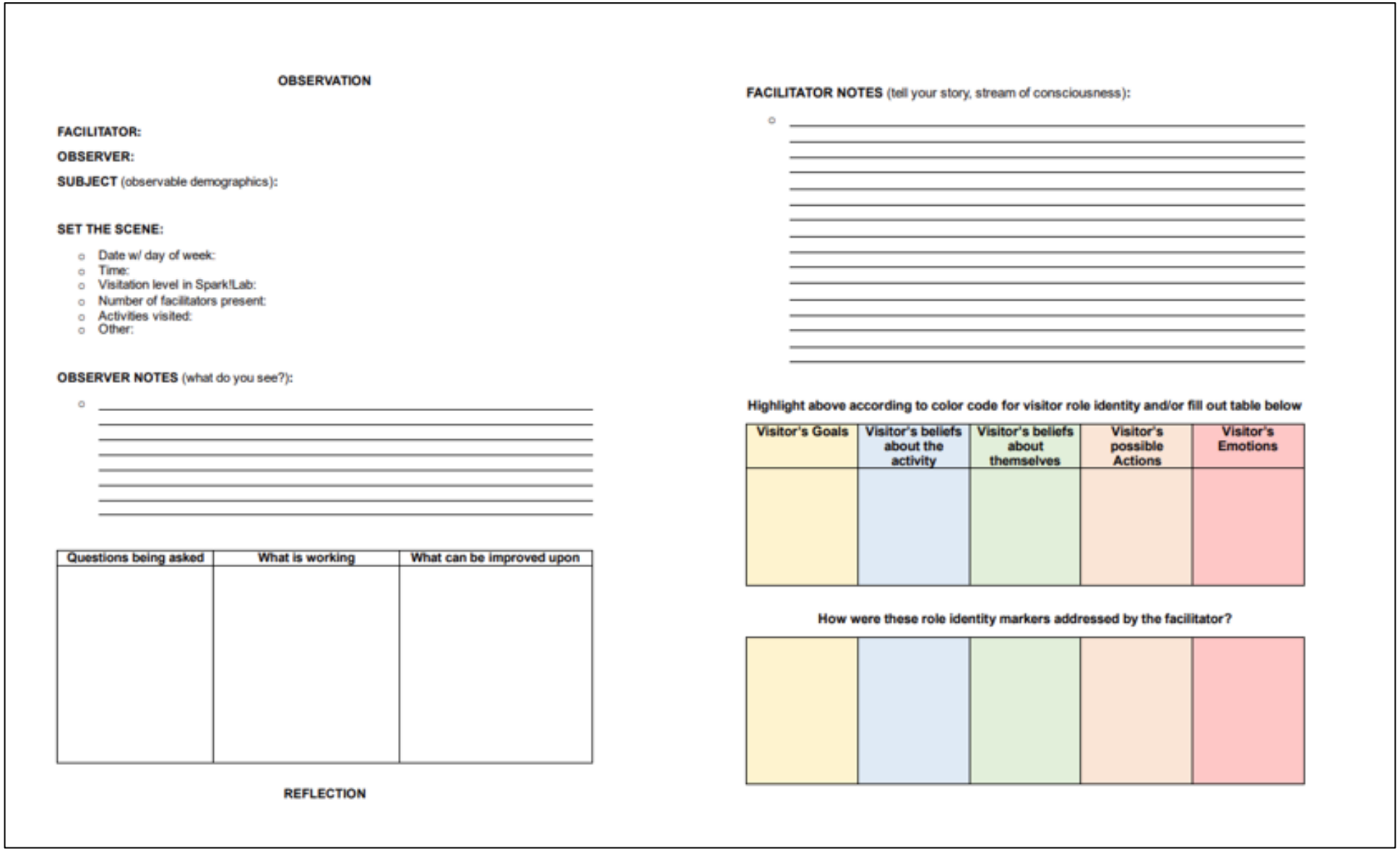
Meaningful moment	Analysis	Tool
Let them explore first! Then help them if they are stuck. I asked him to observe.	Observe, then ask questions to prompt further observation and exploration. Questions can help lead visitors towards an outcome without giving them the “right answer.”	Observe
You’ve just invented something! Let’s see your prototype!	Using inventive language in questions, affirmations, and conversation with visitors, reinforces their self-perceptions as inventors. Directly relate what they are doing to invention.	Confer
Talking to the children about their inventions, hearing about what it is (what they call it) and why they chose to make it. Ask open-ended questions…be a coach.	Give the visitors space to share their invention and reflect out loud on what they made. This step opens the door for further invention opportunities and the opportunity to reinforce feelings (self-perceptions) of accomplishment and (beliefs about) inventiveness.	Invite
There’s no right or wrong answer. There may be a usual way someone approaches a station, but they are free to do something different.	It is important to allow the visitor to explore options (action possibilities) themselves rather than beginning the interaction by pointing out the “correct” answer. Give permission for the visitor that it’s safe for them to explore their own inventive identity, not fit into one they think they have to fit. This concept can be uncomfortable for visitors and helping them understand this concept through facilitation is important. Even though they may not have achieved the specific goal they wanted, they are still an inventor because they engaged in the invention process.	Reinforce
I celebrated with him. He was pleased to see my joy in his accomplishment.	Directly relate what they are doing, and the positive emotions we were experiencing, to invention.	Encourage

Appendix iii. “Meaningful Moments” – how Spark!Lab facilitators honed their inventive identity facilitation tools

Spark!Lab facilitators and volunteers collected and analyzed “meaningful moments” – recollections of interactions in which they perceived they had helped the visitor engage in inventive identity exploration.

Meaningful moment	Analysis	Tool
Dad as translator.	Use family members or other staff to help break language barriers. Everyone is inventive in Spark!Lab and language shouldn’t prevent this. It is so important to break down barriers that may be preventing visitors from feeling safe to explore their identity. Perhaps other ways are providing sensory resources, space when visitors need it, friendliness and openness.	Welcome
At the door, I would tell inventors “invention just started here but it doesn’t stop!”	Help visitors think about invention beyond the space and connect their own lives to invention. Other questions could be “what inventing do you do at home?” “Have you ever seen or done something like this?” “What will you invent next?”	Motivate
How would you connect the battery and motor together using wires?	Ask leading questions if visitors are stuck, keeping the emphasis on them figuring it out via testing and tweaking, rather than just telling them the “right” answer.	Scaffold
I interacted with the girl, asking silly questions related to the project she was working on – like, the opposite of what it was supposed to do. Just really unusual things. Encouraged her to explain how it worked.	Open their mind to the seemingly impossible through imagination, get them to think creatively out of the box (new action possibilities, new goals). Challenging the visitor or getting silly. Piquing the imagination and creating scenarios that may or may not be plausible can get visitors thinking about different possibilities, maybe warming up their brains to be more receptive to invention.	Enhance
Sketched a design and then used the materials at the Invention Hub to make a prototype.	Work alongside or with the visitor towards the same goal.	Collaborate

Appendix iv. “Peer Observation Sheet” – how Spark!Lab facilitators document peer observation to help one another learn inventive identity facilitation techniques



OBSERVATION

FACILITATOR:

OBSERVER:

SUBJECT (observable demographics):

SET THE SCENE:

- Date w/ day of week:
- Time:
- Visitation level in Spark!Lab:
- Number of facilitators present:
- Activities visited:
- Other:

OBSERVER NOTES (what do you see?):

-

Questions being asked	What is working	What can be improved upon

REFLECTION

FACILITATOR NOTES (tell your story, stream of consciousness):

-

Highlight above according to color code for visitor role identity and/or fill out table below

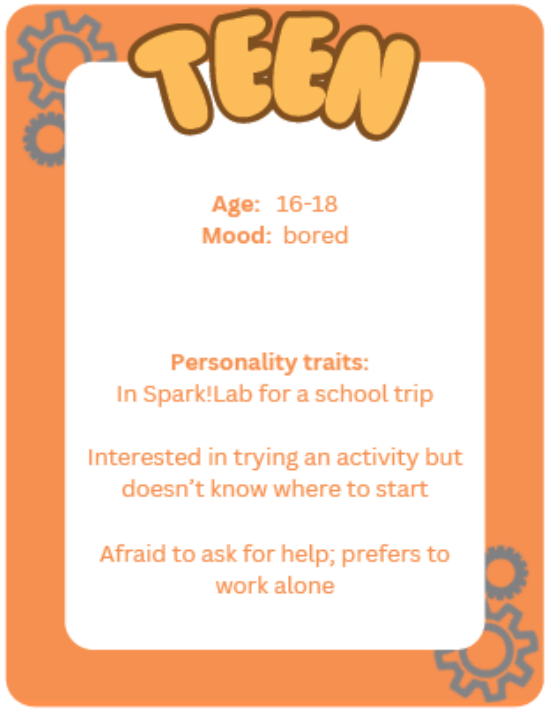
Visitor's Goals	Visitor's beliefs about the activity	Visitor's beliefs about themselves	Visitor's possible Actions	Visitor's Emotions

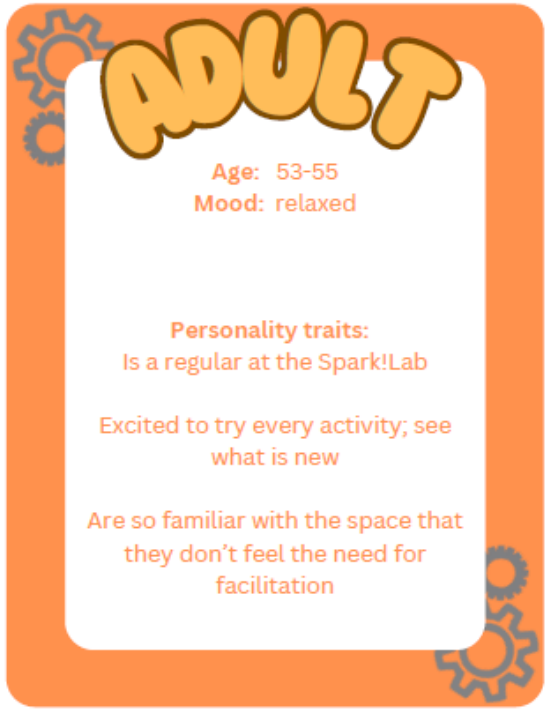
How were these role identity markers addressed by the facilitator?

Appendix v. Inventive Identity Facilitation Toolkit Game

This training game, developed by the Spark!Lab DC facilitators, involves using scenarios to prompt discussion of how staff can use the inventive identity facilitation strategies (left) to promote aspects of visitors' identity exploration (right). Enlarge the images then print, separate, and laminate the terms. Use popsicle sticks to make signs out of the terms on the right.

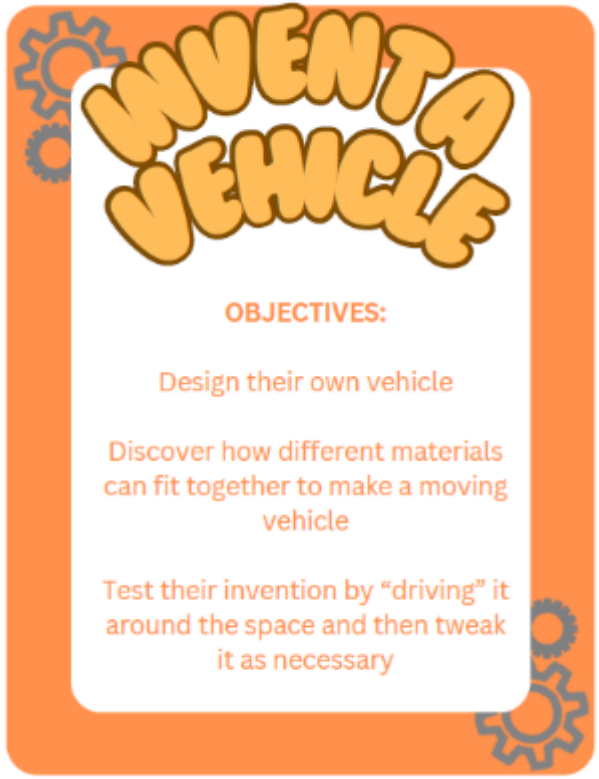
Appendix vi. Facilitation scenarios designed to foster discussion about tool use during the Training Game





Which inventive identity facilitation tools would you use, and why? Consider these simple scenarios and select one or more tools and one or more inventive identity components. Discuss with colleagues.

Appendix vi. Facilitation scenarios designed to foster discussion about tool use during the Training Game



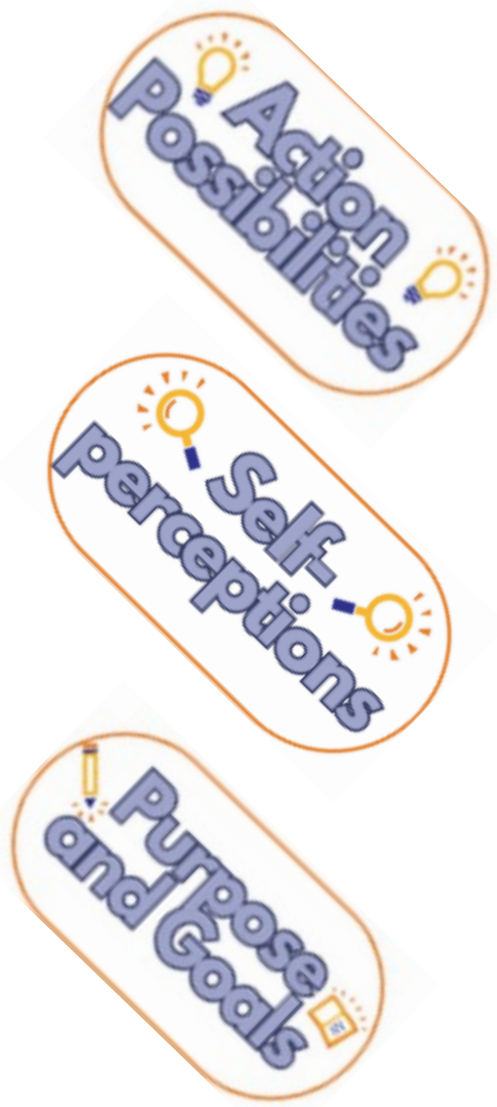
Enlarge, print, separate, and laminate the cards. Discuss with colleagues how different activities may invite particular inventive strategies and facilitation tools.

Appendix vi. Facilitation scenarios designed to foster discussion about tool use during the Training Game

EXAMPLE 1: A girl about 8 or 9 years old is alone at "design protective gear". As you observe, you notice that she has already established a baseline by testing the machine without a helmet and has moved onto testing the machine with the helmet and adding padding a little at a time to determine how to best protect the head.

Would you interact with this visitor; why or why not? If so, what tools could be used in this scenario?

This is a common scenario we see in Spark!Lab where a visitor is very engaged with the activity and is exploring the invention steps on their own, so the question is "Would you interact with this visitor; why or why not?" When implementing inventive identity facilitation, the answer to this should always be yes! Since they are already well engaged, try to "Scaffold" their experience by offering a new challenge, elevate their experience. Another option that can be implemented is to "encourage" them and "reinforce" their identity as an inventor by applying "inventive language" and thus associating what the visitor is doing with that of an inventor. These are the tools that were applied by the volunteer by approaching the visitor and complementing her on being an excellent engineer.



Appendix vi. Facilitation scenarios designed to foster discussion about tool use during the Training Game

EXAMPLE 2: A 8-10 year old girl comes up to you at the HUB station and asks "How do I do this?" looking for a specific answer. Both the girl and the accompanying adult are from China, but the adult seems to be able to communicate English better than the little girl.

What tools can you use to help answer the girl's question and get her started thinking inventively?

This is very common question to receive when facilitating especially if the inventor doesn't know where to begin. This scenario poses an interesting challenge with the language barrier between the facilitator and the visitors. First, make sure the visitors feel comfortable in the space and try, like the volunteer did, to "welcome" the inventor by using the dad as a translator and then "enhance" their curiosity by inviting them to use their imagination and take any path they'd like. Try "conferring" with the visitor using inventive language and "collaborate" with them in building a prototype and testing it.

Appendix vii. Template for community events focusing on inventiveness in sports

Beyond unfacilitated exhibition galleries and facilitated educational spaces, ISL professionals can also help visitors explore their inventive identities through engaging public programs. The following event template is designed to help ISL professional conceptualize community programs to foster inventive identity exploration.

Appendix vii. Template for community events focusing on inventiveness in sports

NOTE

The following is a planning template, outlining priority elements that need to be considered, organized and executed for a program to be successful. It does not (and can not) account for all the intricacies of an event that would be necessary to bring it to life. These questions can only be answered and opportunities defined through the structure definition this document proposes, the detail it asks for and the way in which it suggests the event be planned and developed.

Appendix vii. Template for community events focusing on inventiveness in sports

Background

In this section, develop an overview of the event theme, concept and its ideal outcomes. Share the history behind the project, the impetus for its creation and the partners that will be featured. Provide an overview that can serve as the introduction for the project to any third parties that are unaware of the event host and/or the organizing body for the event. This section grounds the project in its "why" and its high-level "how."

Educational/Impact Objectives

Clearly define what success looks like for the event hosts and/or the organizing body for the event. How are you going to engage audiences? What do you want priority audiences to learn/feel while engaging in the event? Use these objectives to ensure all key parties are aligned against how the event will be developed and executed. This section ensures outputs and outcomes can be measured, and all partners agree to the primary event experience goals.

Strategy

Identify the major tent poles of the event and the means through which it will be designed, developed and the way it will come to market. Identify all the major players and the 10,000-foot view of what the event will look like from a content standpoint. Define the types of experiences that the event will feature and the types of participants it will include. This section articulates to all engaged parties how the event will be designed, what it will feature (and not feature), and serves as the answer to the question of "what exactly is this event and what will it be like?"

Priority Audience(s)

Specifically, and in as much detail as possible, identify the ideal participants for the event.

Appendix vii. Template for community events focusing on inventiveness in sports

High-Level Event Experience Overview

Provide an initial, high-level run of show and experience breakdown. Use this section to align key partners and event invitees (participants) to the key event elements, when they will happen, in what order, and the general approach to how they will be executed. Note the recruiting strategy for any external audiences that need to be present for the event to be a success.

Staffing/Roles

Identify all key parties that will be working the event. Define which groups are leading planning, content development, event logistics, marketing, and all other key event elements.

Event Management Approach

- *Using a 12-month runway, identify key partners and initiate preliminary dialogue to ensure all parties are committed and philosophically aligned against the goals and approach for the event*
- *Define roles and responsibilities*
- *Define communication protocols and ensure they are met*
- *Define meeting cadence, duration and expectations*
- *Name an individual or organization to serve as the central planning entity*
- *Coordinate bi-monthly meetings for the first six months, monthly meetings for the next four months, and then weekly meetings for the final eight weeks before the event*
    - *Use these meetings to make all key decisions and move the group forward on all fronts toward content development, partner recruitment, logistics and all other central event components.*
    - *Additionally use this time to brainstorm key creative concepts and make key decisions (e.g: who will keynote the event? How shall partners be integrated? How can the group troubleshoot logistics challenges?*
- *Establish working groups for all major deliverables and responsibilities*
    - *All groups and individuals report on these elements during meetings*

Appendix viii. Example Community Event Outline

Game Changers: Invention, Sports & Style

NMAH, February 14-15, 2025

Background

The Smithsonian Institution's Lemelson Center (LC), The United States Patent and Trademark Office (USPTO) and Politics of Patents (POP) are working collaboratively to create an event that will explore the compelling intersection of invention/intellectual property, sports and women's fashion/apparel. The event is scheduled for February 14-15, 2025, with school workshops happening on February 14 and the public family day program on February 15.

The Smithsonian's Lemelson Center for the Study of Invention and Innovation at the National Museum of American History (NMAH) unveiled its "Change Your Game"/ "Cambia tu Juego" (CYG) exhibition in March 2024. The bilingual English-Spanish exhibition introduces the central role of inventors, inventions, and technology in the history of sports with an unexpected goal: to empower diverse visitors–with a special focus on adolescent girls, African American youth, and people with disabilities–to explore their own inventiveness and identify themselves as inventive problem solvers who can become "game changers" in their daily lives.

In addition to CYG, the NMAH features "Object Project," an exhibit that highlights "everyday inventions that changed everything." It presents familiar objects in a new light, exploring how people, innovative things and social change shaped life as we know it. From refrigerators, and bicycles, to ready-to-wear clothing, and household conveniences as diverse as window screens and deodorant, visitors have the opportunity to see and handle objects and explore their significance through primary sources and compelling activities. Alongside activities hosted by the USPTO's Eastern Regional office and Politics of Patents, CYG and Object Project content will bolster the impact of this event, allowing guests to explore how innovations in ready to wear clothes transformed sports, especially for women from the 1890s to today.

Appendix viii. Example Community Event Outline

Game Changers: Invention, Sports & Style

NMAH, February 14-15, 2025

Educational/Impact Objectives

- Help guests understand and explore their inventive identities through sports activities
- Provide opportunities for hands-on/minds-on invention and learning experiences
- Motivate the study and pursuit of invention, intellectual property protection and entrepreneurship through sports related examples
- Highlight USPTOs work stewarding invention/supporting communities in a sports context
- Use the lens of the Change Your Game exhibit as an entry point to engage event goers

Strategy

The event we are creating is the first in a series that we will execute across the country, in USPTO regional markets. In this sense, we are creating a template that USPTO, Lemelson Center and other host partners can replicate.

At the highest level, the vision for this event series is to create a one-day gathering that brings together inventors, students/teachers, local industry, and other community-minded organizations to engage in activities, discussions, and celebrations of inventive identity and those who have used it to change sport or the world for the better. On the day prior to the event, we will host a series of student visits to engage in this content directly via activities and exhibitions.

Target Audience & Admission

Initial target audiences: families and children

- Additional target audiences open for group ideation

Target audiences for the CYG exhibit are:

- Young women aged 10-17
- African American youth aged 10-17
- Persons with Disabilities

Appendix viii. Example Community Event Outline

Game Changers: Invention, Sports & Style

NMAH, February 14-15, 2025

High-Level Event Experience Overview

February 14 (School groups participate in educational activities day prior to event)

- **Event Time: 10 am - 2:30 pm**
  - Cohort 1 - 10 - noon am (Arrival 9:30)
  - Cohort 2 - 12:30 - 2:30 pm (Arrival noon)
- **Recruiting Strategy**
  - Work with DCPS to recruit 3 cohorts of 100 students each
  - Focus on target audience groups, if possible
- **Experience**
  - CYG-facilitated rotation-based experience
    - Divide larger cohorts into three smaller groups
    - Move them sequentially through a series of station-based activities
  - Four rotations, 25 minutes each (5 minutes transition time for each)
    - Rotation 1: Spark!Lab hands-on activities
    - Rotation 2: Guided CYG exploration
    - Rotation 3: USPTO educational activities
    - Rotation 4: POP educational activities
- **Staffing**
  - CYG leads all exhibit tours and CYG educational activities
  - USPTO/POP team leads related educational activities
  - NMAH Docent corps presents hands-on carts in Object Project

Appendix viii. Example Community Event Outline

Game Changers: Invention, Sports & Style

NMAH, February 14-15, 2025

February 15 (Event Day)

- **Event Time: 10 am - 5:30 pm**
  - Set-up: 9 - 10 am
  - Tear-down: 5:30 - 6:30 p.m
- **Event Location**
  - Wallace H. Coulter Plaza
- **Experience**
  - Free-flowing experience for guests, comprised of these elements
    - Station 1: Guided Change Your Game exhibit exploration
    - Station 2: Object Project "Wheel Woman" exhibit
    - Station 3: Change Your Game Activities (in WHC Plaza)
    - Station 4: Objects out of Storage from national collections
      - Items connected to historical fashion innovations
    - Station 5: POP Interactive exhibits & activities
    - Station 6: USPTO educational/engagement activities
    - Station 7: Guided Object Project exploration
    - Station 8: Interpretive Object Project carts featuring objects from NMAH's teaching collection.
    - Station 9: NMAL "Descubra"
    - Station 10: "Storytime" with TBD author

Appendix viii. Example Community Event Outline

February 15 (Event Day)

- **Experience**
  - Stage Content
    - Rotating, 20-minute audience engagement sessions with event participants, inventors and other key partners
      - 11 am - Lemelson Center and POP
      - Noon - USPTO and TBD inventor
      - 1 pm - Lemelson Center and POP
      - 2pm TBD inventor
    - **5:30 pm:** Event concludes

Staffing/Roles

- LC leads on all event setup elements, with USPTO and POP support
- LC leads all exhibit exploration and CYG educational activities
- NMAH Docents lead all Object Project exhibit exploration and object carts
- USPTO/POP lead related educational activities/engagement stations
- LC leads logistics and coordination of panel discussion
- OCA leads objects out of storage
- CYG/USPTO & POP combine for day-of marketing/social media

Appendix ix. Further Reading

Garner, J.K., Kaplan, A. & Pugh, K. (2016). Museums as contexts for transformative experiences and identity development. Journal of Museum Education, 41(4), 341-352. https://doi.org/10.1080/10598650.2016.1199343

Kaplan, A., & Garner, J. K. (2017). A Complex Dynamic Systems Perspective on Identity and Its Development: The Dynamic Systems Model of Role Identity. Developmental Psychology, 53, 2036-2051. https://doi.org/10.1037/dev0000339

Kaplan, A., Garner, J.K., Rush, A., & Smith, M. (2023). Designing for diverse museum visitors' identity exploration around inventiveness. Frontiers in Education 8:1078001. https://doi.org/10.3389/feduc.2023.1078001

Appendix x. Contact Information

Thank you for your interest in the Inventive Identity Toolkit! You can contact the authors as follows:

Change Your Game | Cambia tu juego

The Lemelson Center for the Study of Invention and Innovation: lemcen@si.edu

The Spark!Lab Network

Nyssa Buning, Spark!Lab Manager: sparklab@si.edu

The Dynamic Systems Model of Role Identity (DSMRI) and the Visitor Identification and Engagement with STEM (VINES) Framework

Dr. Joanna K. Garner: jkgarner@odu.edu
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Community Events

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