Formative Evaluation

Create.Connect

Conner Prairie Interactive History Park
October 10-14, 2013

By Amanda Svantesson-DeGidio, Gretchen Haupt, and Al Onkka

Science Museum of Minnesota®

Department of Evaluation and Research on Learning

Executive Summary

Science Museum of Minnesota evaluators conducted formative evaluation of the Create.Connect exhibit in October of 2013 as a part of the Prairie Science NSF-funded project. The evaluation focused on two broad evaluation questions.

1. What are the impacts of facilitation, setting, and activity on guests' experiences in Create.Connect exhibits?
2. Do Create.Connect exhibits prompt visitors to make history/science connections?

Children are very engaged in Create.Connect

During this evaluation, we found that the overall median time children spent in the exhibition was 10 minutes and 10 seconds for children approximately 4 to 14 years old. This dwell time is good for an exhibition this size. Children are staying long enough to engage with the ideas in the exhibits. They are not just running through the exhibition on their way outside. The median dwell time has increased since the last evaluation. Most of this time was spent at a few exhibit pieces. The median number of stops in Create.Connect was three.

Facilitation increases engagement

The presence of a facilitator in Create.Connect affected how long children stayed. The median time children spent in the exhibition was greater when a facilitator was present in the area. This was also true at the individual activity tables and benches. Children who interacted with a facilitator at a table or bench tended to stay longer. Children also tended to have more success at activities during times that the exhibition was facilitated. We determined a child to be "successful" if they reached a natural endpoint to the activity or made a visible celebration of their progress.

Historical setting increases engagement

During this evaluation, the Rural Electrification Area (REA) was the only area that was fully developed as a setting. We were pleased to find that this area is working very well as a total STEM and history package. Based on our findings, we believe it promoted the highest overall engagement and learning in children. The Circuit Blocks activity table in REA had the highest median stop time of all the tables. During interviews with families, almost all of the childrens' complex historical thinking (which we defined as making a comparison between the present and the past) was about electricity or about objects in the REA setting. Of the children who gave responses about "old" objects, many identified the objects from the kitchen as "from the past." In contrast, the Rube Goldberg area was highly visited by children, but almost no children made a historical statement or connection about the area.

Create.Connect is succeeding in engaging girls

During the Formative Evaluation, evaluators timed both boys and girls in Create.Connect. The median dwell time in Create.Connect was higher for girls than boys. Girls also stayed longer than boys at every activity table and bench. Their median stop time was higher in each activity, and the difference was greatest at the activities included in the REA setting, which had the richest story attached to it at the time of the evaluation.

These findings suggest that the project team's ideas about facilitation, setting, and activity in Create.Connect are very much on track. We look forward to evaluating the exhibition when all of the areas are fully situated in historic settings.

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Introduction

Science Museum of Minnesota evaluators conducted formative evaluation of the Create.Connect exhibit in October of 2013 as a part of the Prairie Science NSF-funded project. The evaluation focused on two broad evaluation questions.

1. What are the impacts of facilitation, setting, and activity on guests' experiences in Create.Connect exhibits?
2. Do Create.Connect exhibits prompt visitors to make history/science connections?

Evaluators used two instruments and three facilitation conditions to gather data during the formative evaluation.

Facilitation Conditions

In order to learn more about how facilitation impacts guests' experiences in Create.Connect, Science Museum of Minnesota (SMM) evaluators worked with Conner Prairie to set up three facilitation conditions during data collection: costumed, blue-shirt, and "hands-off" or functionally, non-facilitated.

Timing and Tracking

In order to learn how facilitation, setting, and activity impact visitors, evaluators conducted a timing and tracking study. The study focused on children in the target age range (4 – 13 years old) identified in the NSF grant. Timing and tracking built upon the IMLS evaluation work already completed, and helps us understand some new questions:

To what extent do children work with items, iterate, or make something that works at the experiment benches?
How are exhibits (esp. pieces added since the previous evaluation) being used during different facilitation conditions?
Are there differences in how girls and boys visit or use the exhibits (esp. pieces added since the previous evaluation) during different facilitation conditions?
How does engagement in the electricity (REA) area change now that it includes more of a setting?

Family Interview

In order to learn what types of history or STEM connections guests made in Create.Connect, evaluators conducted a "family interview" with groups who stayed more than 5 minutes in the exhibition. These interviews were paired with the timing and tracking study as much as possible. The interview included some questions directed at the child, and some questions directed at the adults in the group. These interviews helped us understand:

What do children say about the exhibition?
What kinds of STEM ideas or connections do children learn or make?
What kinds of history ideas or connections do children learn or make?
What kinds of benefits do adults see in the exhibition for their children?

Evaluators Al Onkka, Amanda Svantesson-DeGidio, and Gretchen Haupt from SMM collected 91 timed observations and 66 family interviews. The preliminary findings from this study were shared at the 2013 ASTC conference in Albuquerque, New Mexico.

I. Timing and Tracking

During the timing and tracking study, evaluators focused on one target child, who entered the exhibition, out of each group. In order to be selected, the target child must have stopped at one exhibit piece for three seconds or longer. Children who did not stop at any exhibit pieces before leaving the exhibition were not selected. Evaluators selected the child who appeared closest to age 13 and observed their entire visit in the exhibition. An evaluator noted the amount of time the target child spent at each exhibit piece on a map and marked important behaviors such as engagement, iterations, success and interaction with a facilitator at the activities. Table 1, below, is an overview of all the children observed, including children of both genders, and over all facilitation conditions. As seen in Table 1, Create.Connect had a high dwell time. Median dwell time was a little over 10 minutes with a maximum dwell time of nearly an hour.

Table 1: Total Dwell Time in Create.Connect (n= 91)

	Dwell Time
Minimum	0:01:06
Maximum	0:52:00
Median	0:10:10

Nearly a third (29%) of the target children tracked spent fifteen minutes or more in the exhibit (see Figure 1, below). Close to half (44%) of target children observed stayed in the exhibit between five and fifteen minutes, and a little over a quarter (27%) stayed five minutes or less. No children who stopped at one exhibit piece stayed less than one minute in the exhibition. All figures were generated from data tables presented in Appendix C, following the report.

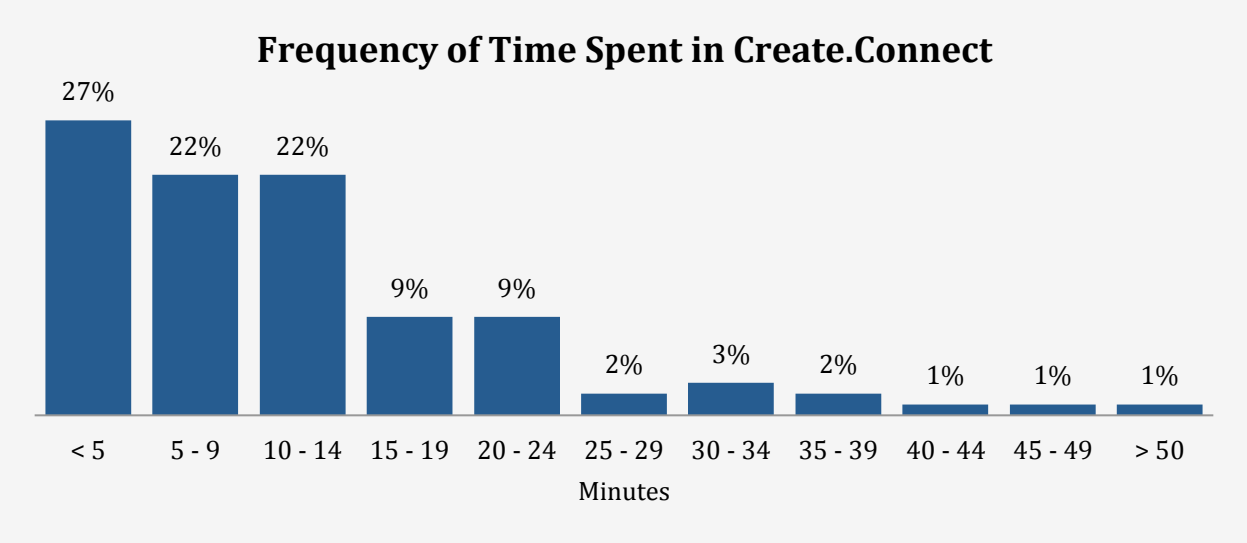


Figure 1

This study measured the time that children spent in Create.Connect as well as the number of stops at individual components. Evaluators compiled the percentage of stops and median time at individual components (Table 2) and exhibit areas (Table 3) of children observed.

Components are organized into four types: Tables (activity tables), Benches (experiment benches), Objects (exhibit pieces or artifacts) and Media (photographs and video).

The median number of exhibit components visited by children was three. In order from most time to least time, children visited and spent their time at 1) activity tables and benches, 2) hands-on or large objects, 3) objects in vitrines, 4) monoliths and tombstones. Media components were the least popular, visited by less than a quarter of the children we observed.

Table 2: Stops and Median Time by Component Type (n=91)

	Stopped	Median Stop Time
Stopped at Any Table Component	**88%**	
Rube Goldberg Table	57%	0:02:58
Circuit Table	44%	0:03:25
Wind Table	38%	0:01:00
Stopped at Any Bench Component	**68%**	
Rube Goldberg Bench	43%	0:01:45
Circuit Bench	27%	0:01:30
Wind Bench	19%	0:02:13
Stopped at Any Object Component	**56%**	
Rube Goldberg Machine	29%	0:00:27
Electricity Object Table	14%	0:00:20
Stove	14%	0:00:33
Wind Charger	8%	0:00:45
Tall Wind Mill (Water Pump)	8%	0:00:29
Fridge	7%	0:00:20
Light & Radio	5%	0:00:15
Meters	4%	0:00:08
Box	1%	0:00:03
Stopped at Any Media Component	**20%**	
Rube Goldberg Tombstone	8%	0:00:44
Media Window	4%	0:00:10
Circuits Tombstone	2%	0:00:37
Circuits Monolith	2%	0:00:38
Rube Goldberg Monolith	2%	0:00:33
Wind Monolith	1%	0:01:15
Rube Goldberg Video	1%	0:00:15
Wind Tombstone	1%	0:00:05
Calendar	0%	No Stops

Over half of the observed children stopped in all three exhibit areas, which include the Rube Goldberg area, Rural Electrification Act (REA) area and Wind area. Percentages are listed first by any stop in the area, then ascending by components in that area. The Rube Goldberg area received stops by over three quarters (76%) of the children observed. Tables and benches had the longest median stop times with tables at a slightly higher median than benches.

Table 3: Stops and Median Times by Area (n=91)

	Stopped	Median Stop Time
Stopped in Rube Goldberg Area	**76%**	
Rube Goldberg Table	57%	0:02:58
Rube Goldberg Bench	43%	0:01:45
Rube Goldberg Machine	29%	0:00:27
Rube Goldberg Tombstone	8%	0:00:44
Rube Goldberg Monolith	2%	0:00:33
Rube Goldberg Video	1%	0:00:15
Stopped in REA Area	**62%**	
Circuit Table	44%	0:03:25
Circuit Bench	27%	0:01:30
Electricity Object Table	14%	0:00:20
Stove	14%	0:00:33
Fridge	7%	0:00:20
Light & Radio	5%	0:00:15
Media Window	4%	0:00:10
Meters	4%	0:00:08
Circuits Tombstone	2%	0:00:37
Circuits Monolith	2%	0:00:38
Box	1%	0:00:03
Calendar	0%	No Stops
Stopped in Wind Area	**51%**	
Wind Table	38%	0:01:00
Wind Bench	19%	0:02:13
Wind Charger	8%	0:00:45
Tall Wind Mill (Water Pump)	8%	0:00:29
Wind Monolith	1%	0:01:15
Wind Tombstone	1%	0:00:05

II. Facilitation

In order to learn more about how facilitation impacts guests' experiences in Create.Connect, SMM worked with Conner Prairie to arrange three facilitation conditions during data collection.

Costume - Historic interpreters in costume used a character-based storyline to orient visitors to the exhibit activities and components.
Blue shirt - Interpreters facilitated activities wearing (blue) staff polo shirts and did not use a character-based storyline.
No facilitation - Staff were present in the exhibit area for safety reasons and to answer questions, but did not initiate engagement with visitors or facilitate activities. Staff were "hands-off."

Evaluators observed the highest median dwell time (12:30 minutes) during costumed facilitation. Dwell time decreased slightly (11:32 minutes) during blue shirt facilitation and dropped (7:52 minutes) during the non-facilitated condition. Figure 2, below, shows the relationship between facilitation and dwell time.

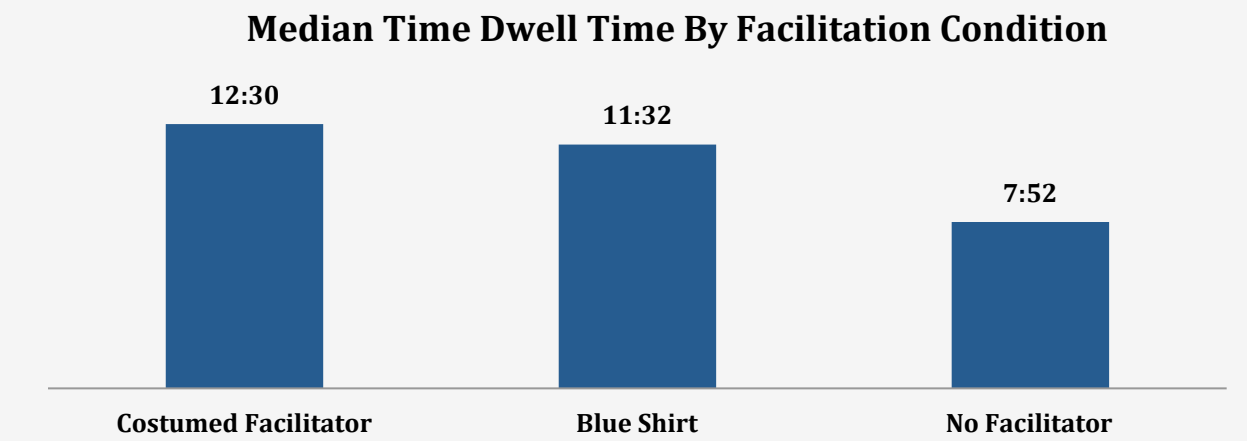


Figure 2

Table 4: Dwell Time by Facilitation Condition

	Minimum	Maxiumum	Median	n=
Costumed facilitator	0:01:06	0:52:00	0:12:30	31
Blue shirt	0:01:09	0:43:23	0:11:32	30
No Facilitation	0:01:06	0:35:04	0:07:52	30

The distribution of time spent in the exhibit shows that of the children observed, the highest dwell times coincide with visitors who visited the exhibition while it was facilitated. Both

facilitation conditions succeed in pushing dwell time past the 19 minute mark. Very few children during the non-facilitated condition made it past 19 minutes.

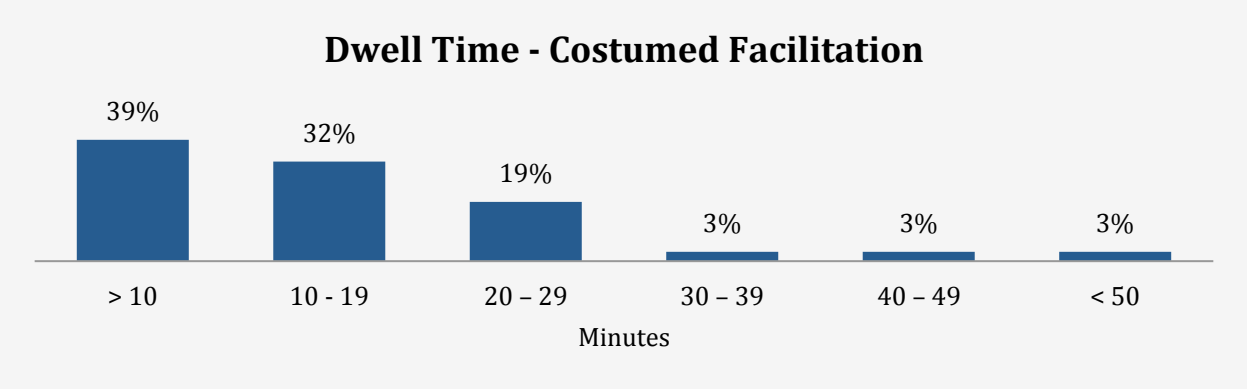


Figure 3

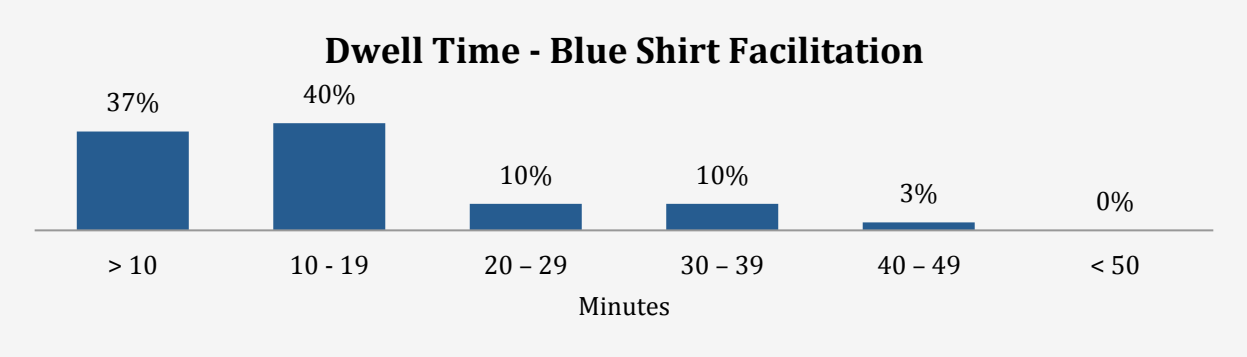


Figure 4

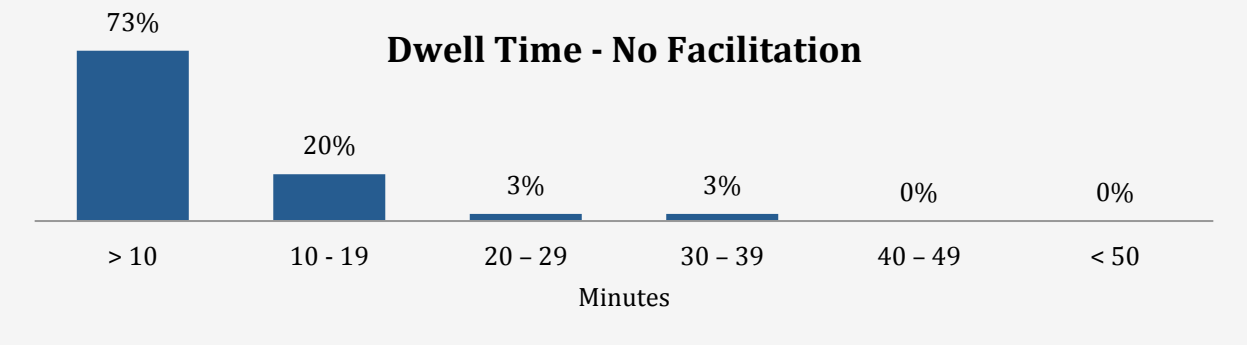


Figure 5

Median stop times at both the benches and activity tables were noticably longer among visitors observed interacting with a facilitator. During the non-facilitated condition, some adults noticed the lack of facilitation and missed it. The following quotes are adult responses from family groups who visited during the non-facilitated condition:

- "I could use some more instruction… either somebody telling and answering questions or providing information."
- "I think the problem is we're passing through here and you didn't really explain things, for instance we were trying to do the something here with electricity and we didn't have any instructions so how could we know- we had to give up because we didn't know what to do."
- "We honestly didn't look. We were standing talking while they were playing."

Figure 6 shows the median stop time for children who did (yes) and did not (no) interact with a facilitator at the activities.

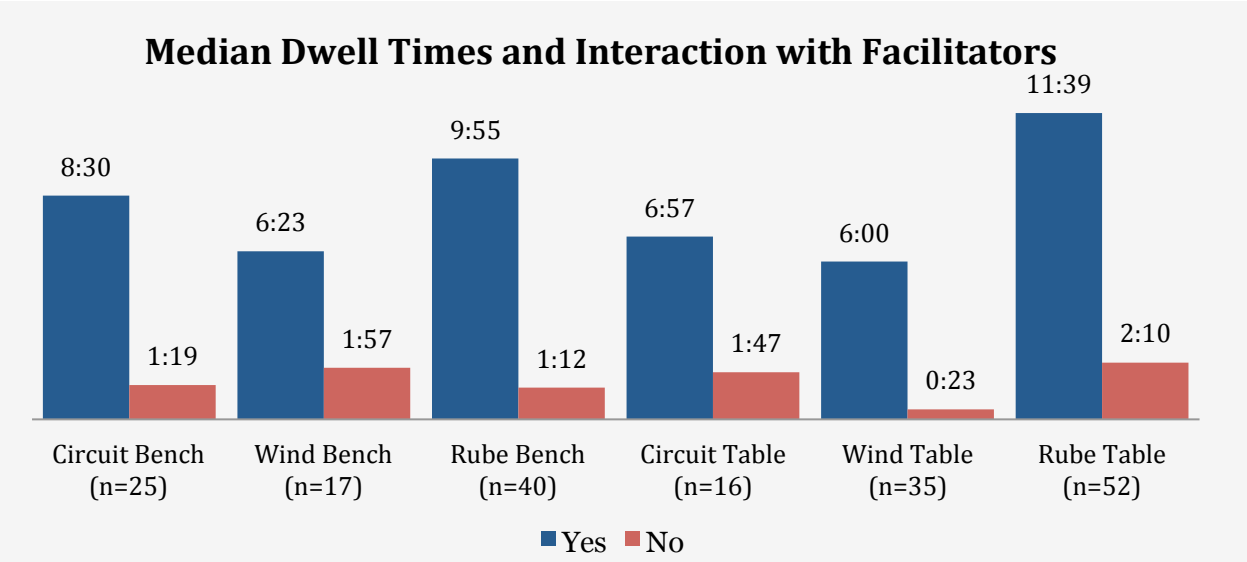


Figure 6

III. Gender

Gender was not a methodological consideration for the instruments of the formative evaluation; target children were selected regardless of gender. Therefore, the following tables and figures use variable and sometimes uneven sample populations. The timing study was designed to measure the length of time the children spent in the exhibition, not the ratio of the genders within it. An attraction study of the visitors to Create.Connect was conducted following the formative evaluation. The attraction study will help supplement gender data for further analysis during remedial and summative evaluations.

Table 5: Dwell Time in Create.Connect by Gender (n=91)

	Boys	Girls
Minimum	0:01:06	0:01:30
Maximum	0:52:00	0:43:23
Median	0:09:12	0:10:29

Table 5, above, shows overall exhibit dwell times for each gender, including minimum and maximum time. The minimum dwell time for both boys and girls is over one minute. The median dwell time is longer for girls (10:29 minutes) than boys (9:12 minutes) as shown in Figure 7, below.

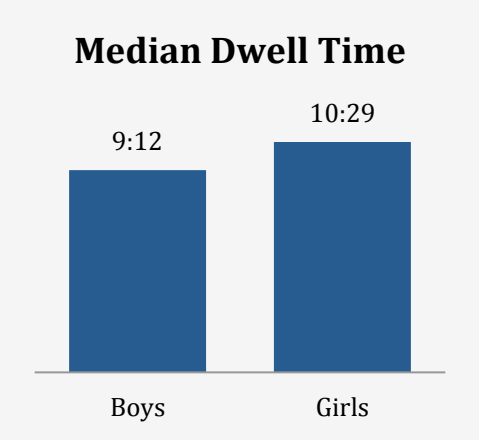


Figure 7

The distribution of time spent in the exhibit shows a more complex pattern of activity between boys and girls. Over half (53%) of boys spent ten minutes or less in the exhibit, compared to less than half (43%) of girls. Although overall dwell time for girls is higher, a small percentage (4%) of boys stayed in the exhibit for 45 minutes or more, as seen in the Figures 8 and 9, below. For specific activities by gender see Table 16 in Appendix C.

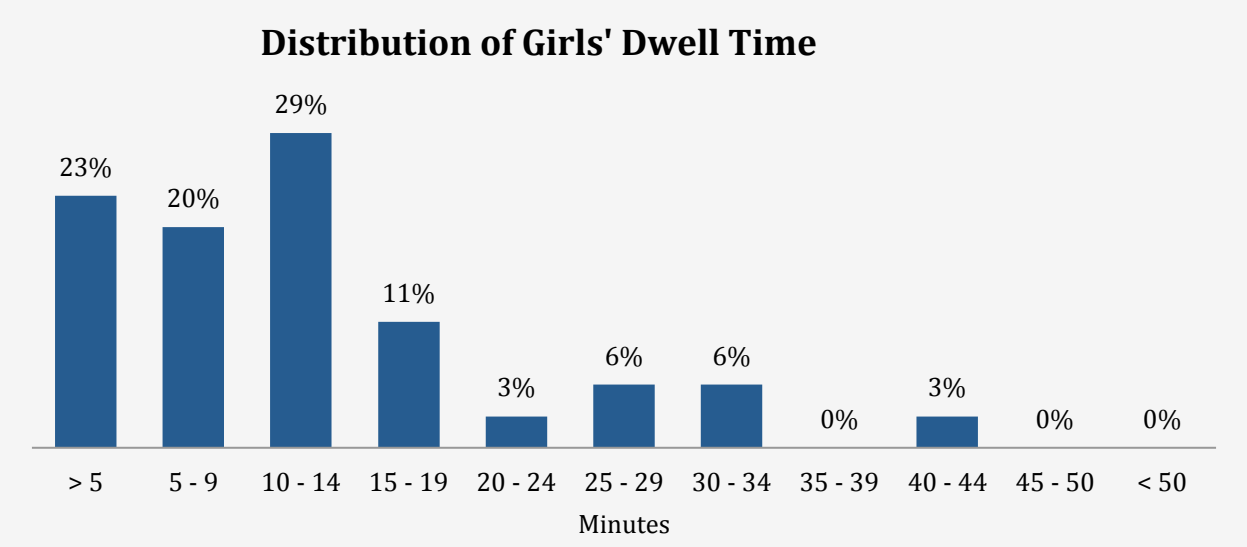


Figure 8

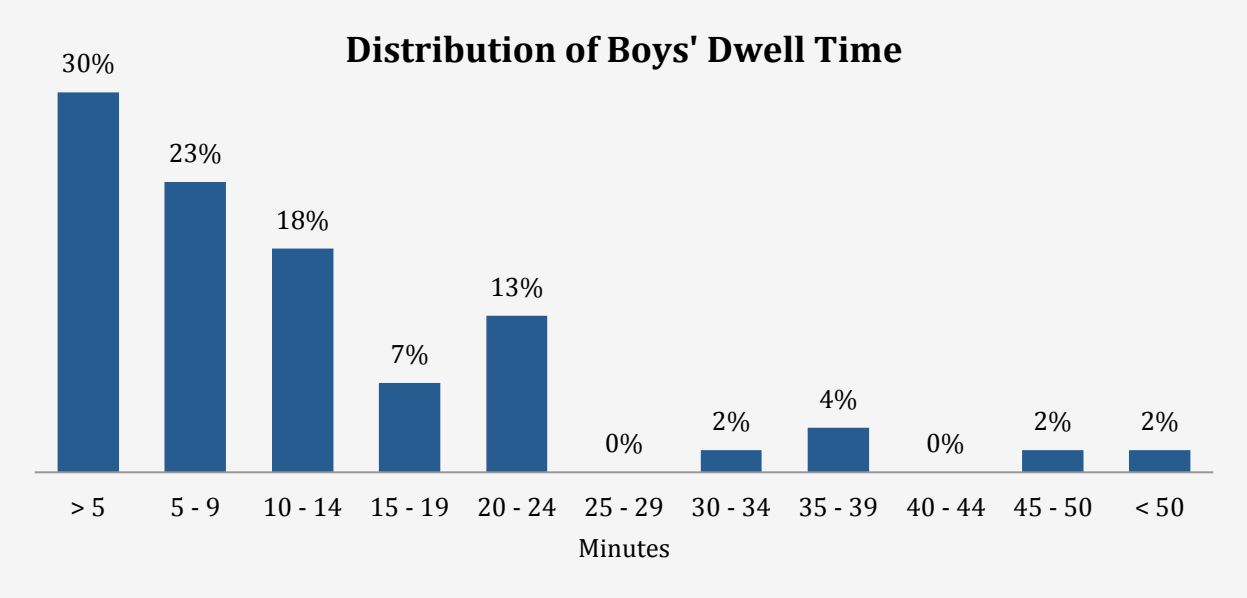


Figure 9

The following analysis includes stop time at activity tables and exhibit benches within the three areas of Create.Connect, which include: the Rural Electrification Area (also called REA or Circuits), wind power, and Rube Goldberg. Figure 10, below shows stop times for each gender, at each bench and activity. The stop time across all benches and activities was higher for girls than boys. See Table 16 in Appendix C for the number of girls and boys who stopped at each component.

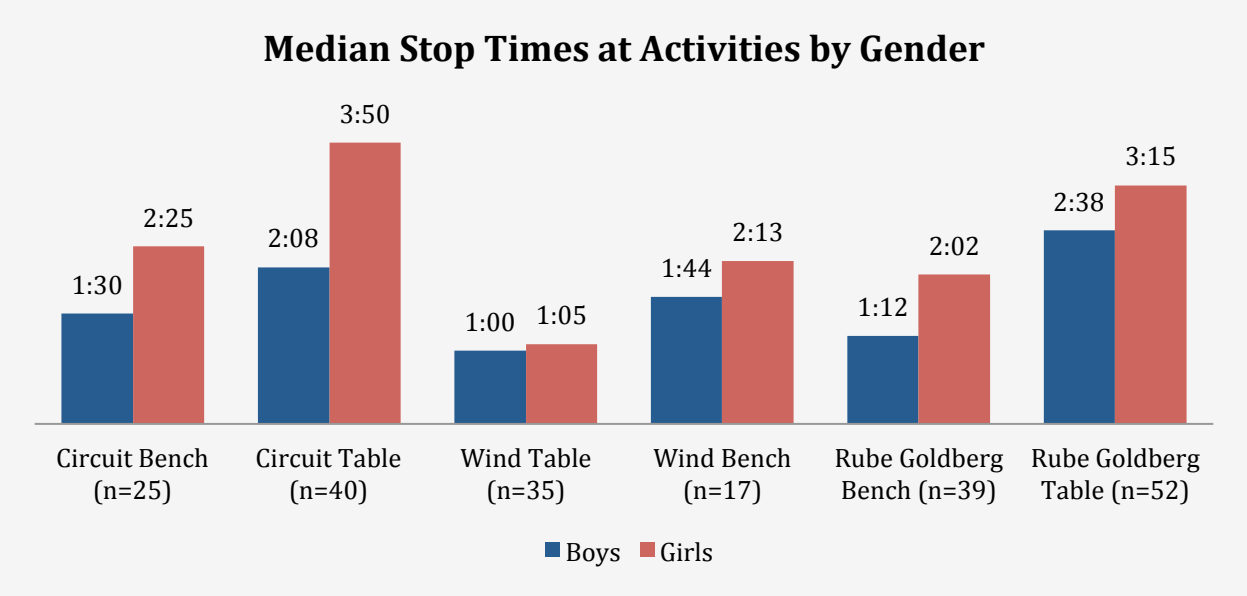

Median Stop Times at Activities by Gender
1:30
2:25
2:08
3:50
1:00
1:05
1:44
2:13
1:12
2:02
2:38
3:15
Circuit Bench (n=25)
Circuit Table (n=40)
Wind Table (n=35)
Wind Bench (n=17)
Rube Goldberg Bench (n=39)
Rube Goldberg Table (n=52)
Boys
Girls

Figure 10

IV. Gender and Facilitation Conditions

In order to better understand the engagement patterns between genders, SMM evaluators examined dwell times within each facilitation condition for both boys and girls. Median dwell time for boys was highest during costumed facilitation, where Conner Prairie historical interpreters wore period costume and related a character story to the activity. Dwell time for boys during blue shirt facilitation dropped nearly in half (from costumed), while dwell time for girls was highest during the blue shirt condition (see Figure 11 below).

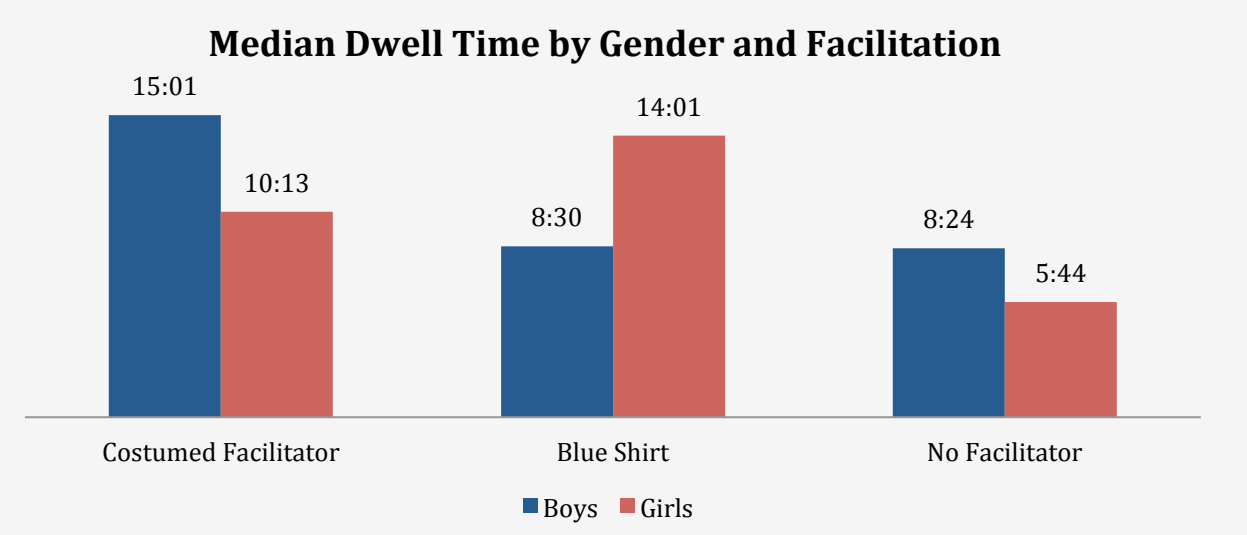


Figure 11

It is unclear what accounts for these differences in engagement between the genders during different facilitation conditions, and there may be multiple factors.

Figures 12, 13, and 14, below, present a more focused look at the frequency of time spent in Create.Connect for each gender and within each facilitation condition.

During costumed facilitation (see Figure 12, below), both boys and girls shared a high dwell time. Of the children sampled during timing and tracking, over half (60%) of boys and over a third (43%) of girls spent between 10-29 minutes in the exhibit during costumed facilitation. Although a larger percentage of boys stayed longer during costumed facilitation, a larger percentage of girls stayed longer during blue shirt facilitation. Few children stayed past 19 minutes during the non-facilitated condition

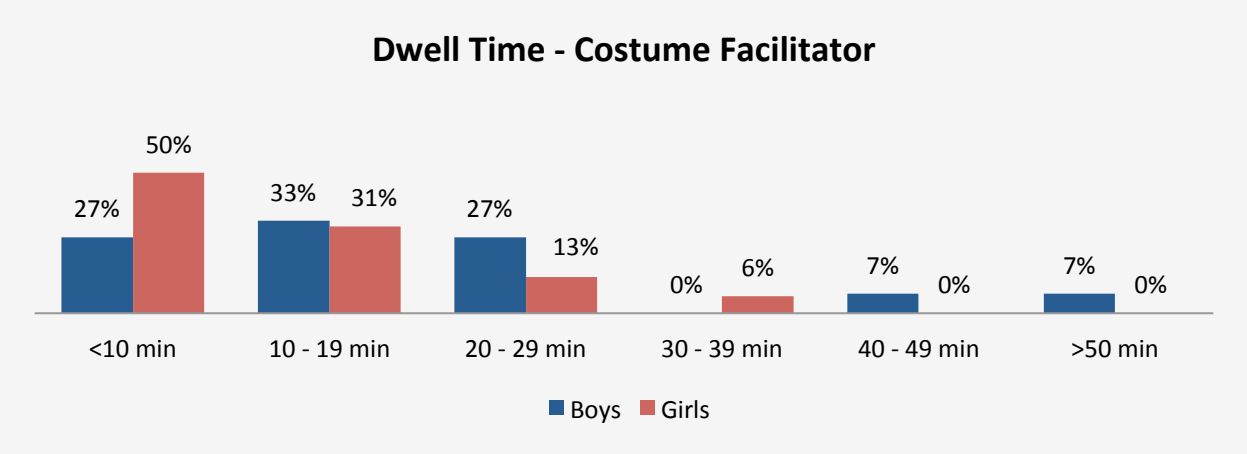


Figure 12

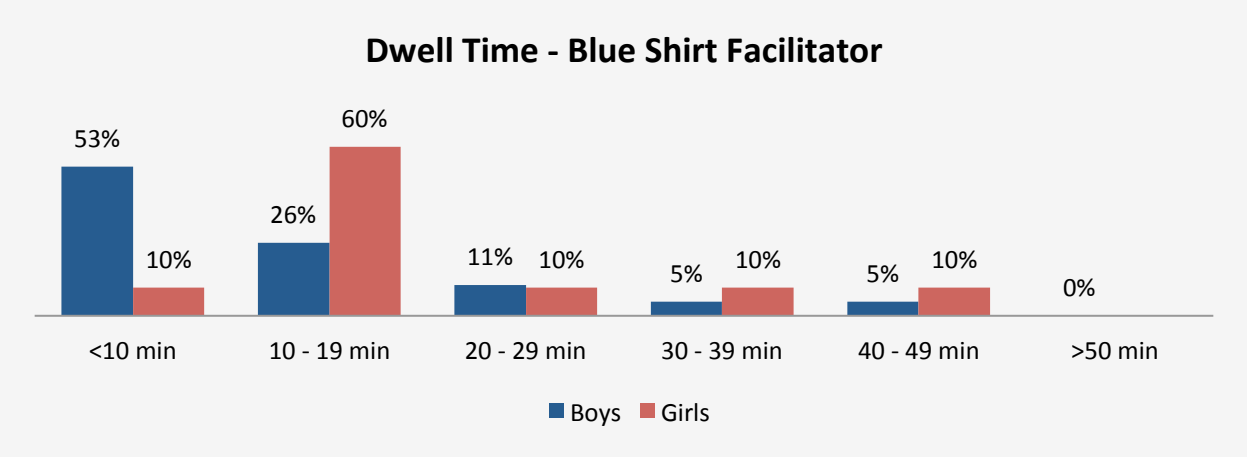


Figure 13

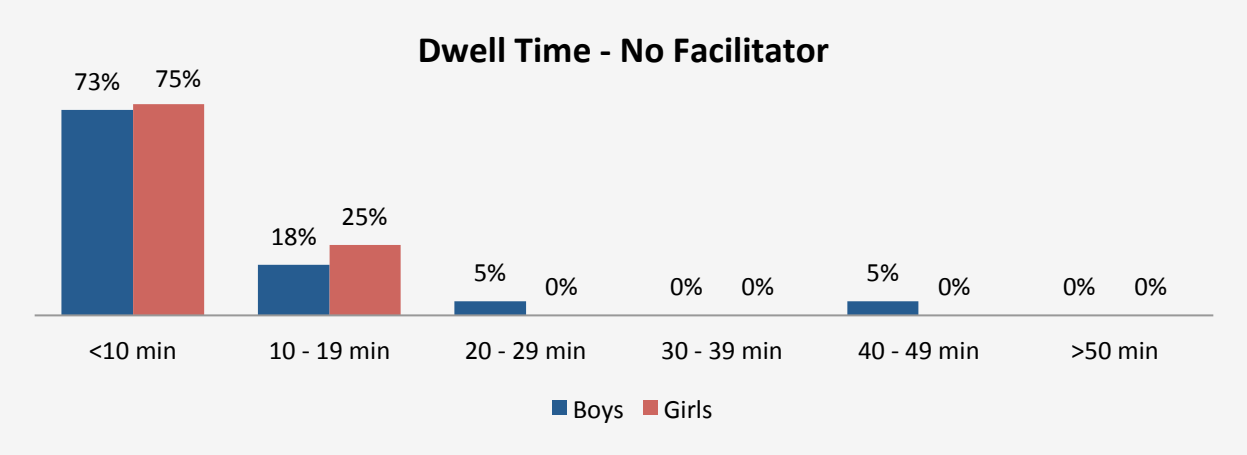


Figure 14

Table 18 in Appendix C shows median times for both genders at each exhibit bench and activity table, during each facilitation condition. Please note that some of cells in the table have a very small n.

V. Additional Indicators of Engagement at Activities

The timing and tracking study included three additional behavioral indicators of engagement that were measured using a yes/no dichotomy for the overall time a child spent in the exhibit:

- Work: Did the child use the materials at the activity (rather than just look at them)
- Iteration: Did the child try a portion of the activity more than once?
- Success: Did the child appear to succeed at the activity?
    - Success included finishing an activity or any observable positive reaction (smile, shout, high-fiving etc.) about the finish point of their activity.

Over half of the observed children in Create.Connect exhibited each of these behaviors: 87% of all observed children worked with an activity, 62% of all observed children iterated at an activity, and 52% of all observed children had success at an activity (see Figure 15 below).

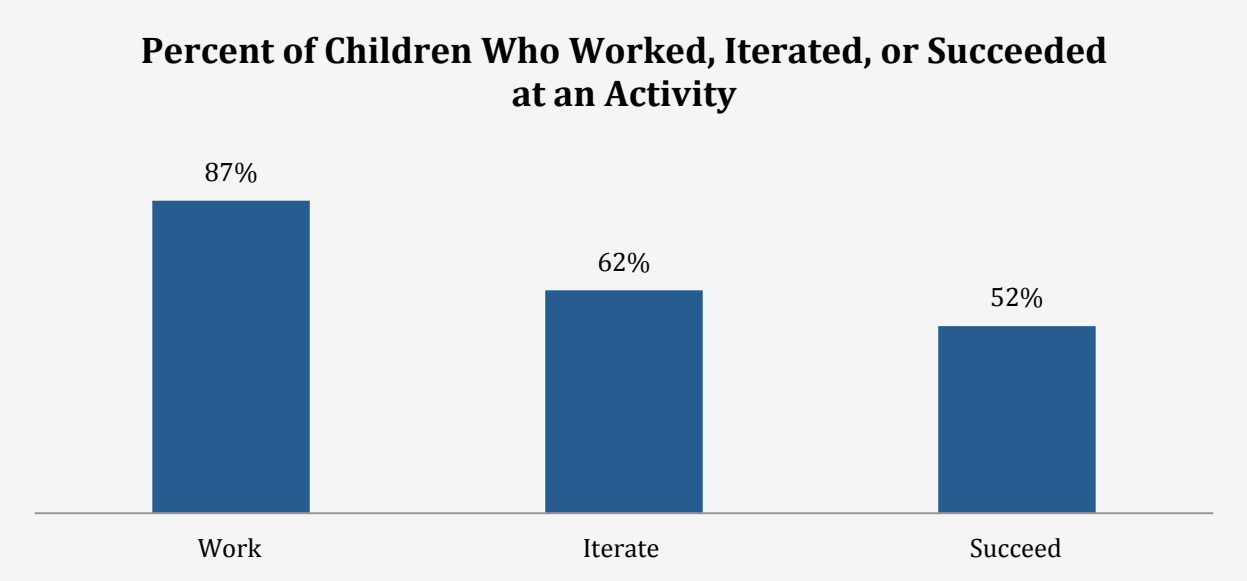


Figure 15

Working at an activity is a precondition to iterating and succeeding. When we focus on the children who worked at an activity under each condition we find that iteration stays about the same, while success decreases during the non-facilitated condition (see Figures 16 and 17, below).

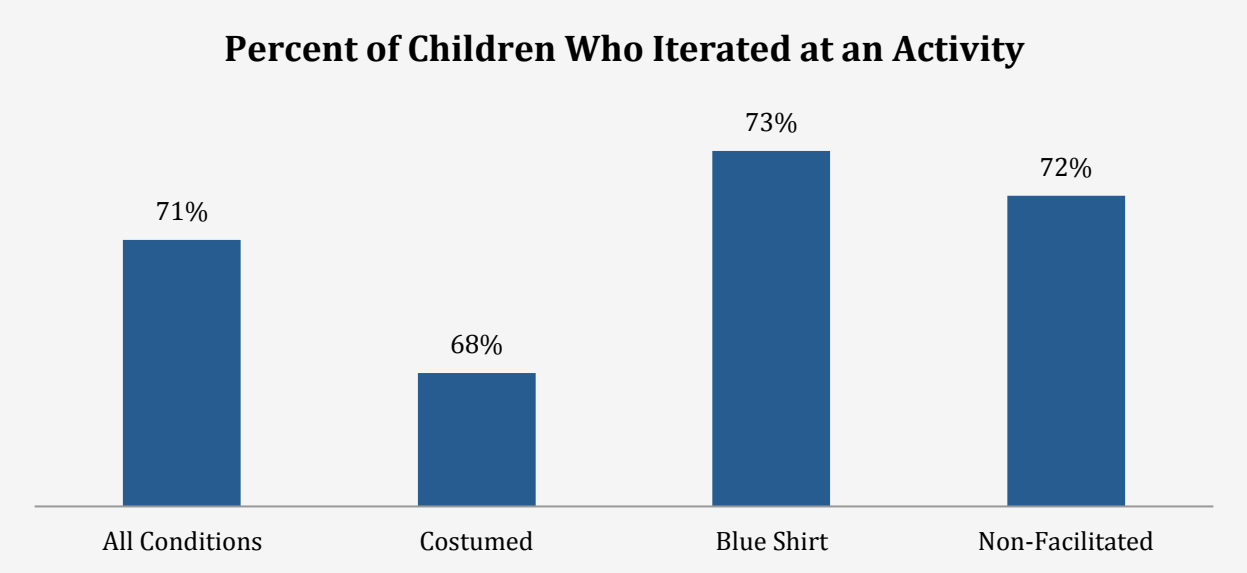


Figure 16

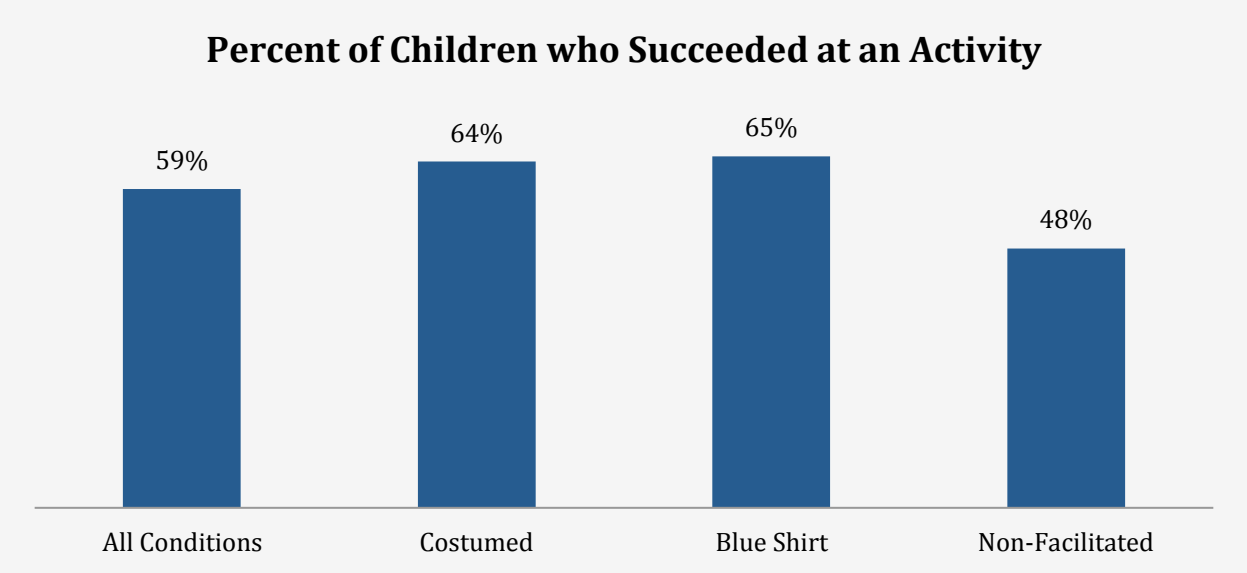


Figure 17

Of the children who worked at an activity, roughly the same percent of boys and girls iterate, however, girls are more likely to have success at the activities (see Figure 18 below).

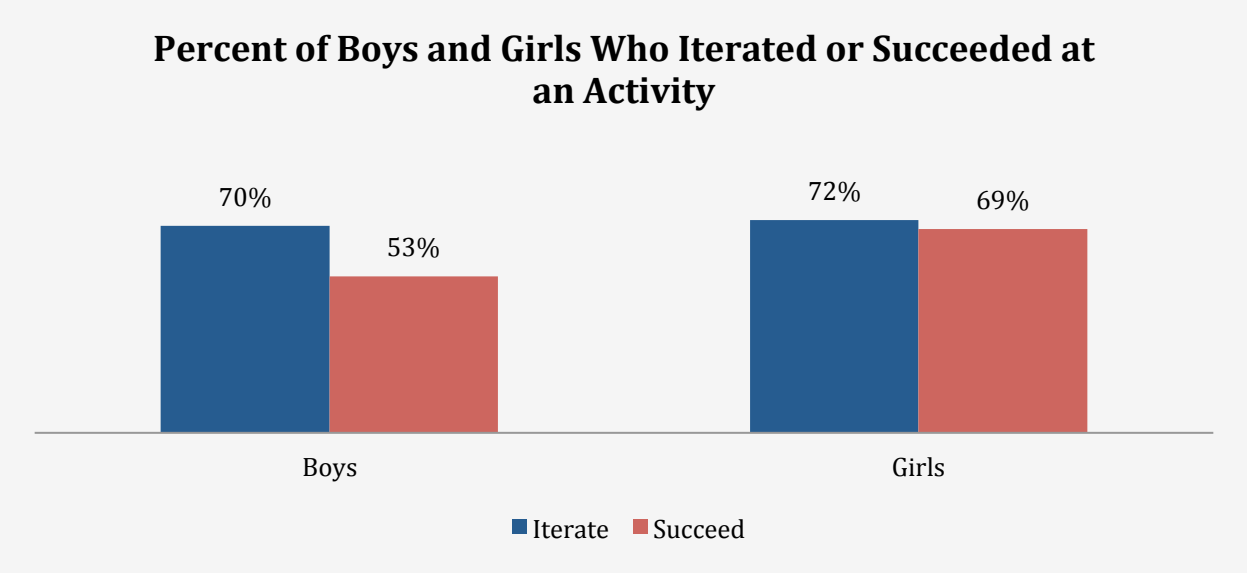

Percent of Boys and Girls Who Iterated or Succeeded at an Activity
70%
53%
72%
69%
Boys
Girls
Iterate
Succeed

Figure 18

VI. Family Interviews

In order to learn what types of history or STEM connections guests made in Create.Connect, evaluators conducted 61 family interviews with groups who stayed more than 5 minutes in the exhibition. When possible, participants to the timing and tracking study were interviewed. A great majority of the interviews are with timing and tracking participants. The interviewer asked some questions of the child and some of the adults in the group. We designed the interview to be non-directive. We did not want to "teach" children the answers to our questions through the interview process. Because of this, parents often facilitated or reiterated our questions to children. This led to interviews with rich discussions and multiple responses.

Rich Discussions and Multiple Responses

During the family interview, evalutators asked questions about STEM and history learning, engagement, and interest. Due to the nature of family or group interviewing, some responses include both the adult and child's responses, or the responses of accompanying parents and siblings. This type of interview allowed for rich discussions about STEM knowledge and historical context. The responses were coded in various ways to accommodate multiple-speaker responses. Questions directed at adults and children were coded separately. Children did not tend to interject during questions directed at adults, but adults or other children may have interjected during questions directed at the target child. The child responses that include both an adult and child speaker are marked with an asterisk in the appendices. Although 91 interviews were conducted, responses, rather than respondents, were coded. Thus, one interview may have responses from multiple children or adults.

Child Interview Coding Method

We knew that interviewing children for this evaluation would be fun, challenging, enlightening, and frustrating. We believe the following coding process was the most accurate way to describe the child responses. The following questions were asked of children (with a consenting adult) upon exiting Create.Connect. Multiple prompts were used to engage children and elicit responses.

- What did you do at [exhibit(s) visited]?
- What did you learn about [wind, electricity, simple machines, the fridge etc.]?
- Did you see anything or anybody that came from the past?
- What does [something they talk about or saw] tell you about people who lived in the past?
- Why do you think [Conner Prairie] wanted kids like you to see it?

Responses to the first two questions were analyzed as one data set (Data Set 1), pertaining to STEM learning. Responses to the last three questions were coded into another data set (Data Set 2), pertaining to history learning. Within each of the two data sets, emergent patterns of either STEM or history thinking were identified and coded. These codes of history thinking, and STEM thinking were further analyzed for sub-codes pertaining to a spectrum of thinking from simple identification of a STEM/history concept, to complex comparisons. The total *n* was calculated by the number of responses within each data set, rather than merely by the number of cases.

Although 91 interviews were conducted, the total number of responses includes siblings or additional children in the group accompanying the target child. Out of the response data, only responses relevant to the question were coded and analyzed. Because children as young as age 4 were interviewed, some children were unable to give answers to interview questions – either because they did not understand the question or did not have a response for it. Only children who answered questions were counted in the total number of responses. In other words, children who did not give a response to a question, or those who gave a response that was not relevant to the question, were excluded from the number of responses.

Adult Interview Coding Method

The following questions were asked of adults who accompanied target children:

- As a parent, what did you like, or not like, about the exhibits in this space?
- What do you think Conner Prairie is trying to show with the exhibits in this space?
- Is there anything in this exhibit that's familiar or reminds you of something you've experienced before outside of a museum?
- While your child was at [exhibit piece or activity] what were you trying to do [with him/her]? What role were you playing

Responses for adult interview questions were separated and coded per question. The responses to each question were separated as individual data sets, then analyzed for emergent patterns. The difference in coding styles between adult and child interview responses was developed because of the difference in comprehension of the questions. Child questions often required various prompts, whereas adults answered interview questions more directly. The responses from each question for adults were therefore more uniform, containing distinct data sets. The number of responses includes various speakers such as both parents and/or other adult group members accompanying the target child. The *n* was calculated for total responses to each data set (question), rather than merely the number of cases. See Appendix B for a full list of coded responses.

Findings

Children's Connections to the Past and STEM Learning

During the interviews, the majority of children (58%) who gave a response were able to articulate some level of connection between the exhibition and the past. For the purpose of this evaluation, historic thinking was defined as describing or making a comparison to the past and also identifying objects from the past. One quarter (24%) of children who gave a response (either about the past or an object) gave a complex response. We coded responses as complex if children made any kind of explicit or implicit comparison between the past and the present.

Half (52%) of the children who gave a response articulated some level of STEM concepts from the exhibition. For the purpose of this evaluation, STEM concepts are defined broadly as STEM learning that relates to the specific exhibit content: electrical circuits, wind energy, force and motion (simple machines). A few examples of reponses are included below. See Appendix A for a full list of coded responses.

- "Machines are hard to learn, but maybe someday I could build something that will become a something."
- "I'm the one with the big ideas. I told mommy what to do because I'm a scientist!"
- "If you connect the wires to the battery and the battery to the farmhouse it makes light!"
- "We have to know everybody that lived in the past and to feel what they felt and figure out stuff. It was harder back then."

Table 6: Data Set 1 - Historical Thinking (n= 98)

		Responses
Described the past		**29%**
Gave a description of what the past was like (simple)	15%	
Made a comparison between the past and the present (complex)	13%	
Described a historical object in the exhibition		**31%**
Identified an object from the past in exhibition (simple)	19%	
Used an object to articulate a difference between past and present (complex)	11%	
Did not give a response in these categories		**41%**

The coded responses used in this table are included in Appendix A. Due to rounding, the sum of the percentages does not equal 100%.

Table 7: Data Set 2 - STEM Thinking (n= 105)

		Responses
Gave a response about circuits		**14%**
Identified electricity	5%	
Talked about connecting wires, batteries, etc, to make the activity work	8%	
Identified that a circuit is a circle	2%	
Gave a response about wind energy		**14%**
Talked about wind energy	6%	
Talked about how blades affect wind energy	9%	
Gave a response about simple machines		**21%**
Talked about the end goal of the ball runs	4%	
Talked about multiple steps in the machine or strategies for success	6%	
Talked about the properties of a simple machine	8%	
Talked about chain reactions	4%	
Did not give a response in these categories		**50%**

The coded responses used in this table are included in Appendix A. Due to rounding, the sum of the percentages does not equal 100%.

Parent Satisfaction and Engagement

Adult responses (coded by individual question) show an overwhelming sense of satisfaction with the dynamic nature of the exhibit, feeling it was a space in which all family members could engage and learn. Nearly all (98%) of adults interviewed made the connection between STEM and history content in the exhibit. When asked what the purpose of the exhibit was, almost a quarter (20%) of adults saw the exhibit as an opportunity to learn and/or use critical thinking skills for themselves and their children (see Data Set 3 and Appendix B). Many parents reported feeling empowered by the facilitators and more able to engage with their child about STEM or history concepts. When asked what they liked about the exhibit, over a third (37%) of adults saw the exhibit as an opportunity to build knowledge.

Table 8: As a parent what did you like or not like about the exhibits in this space? (n=60)

	Percent
Interactive Components	48%
Opportunity to Build Knowledge	37%
General Praise	32%
Specific Component or Activity	30%
Facilitation from Interpreters	23%
Layout and Variety	13%
Negative/Other	5%

The coded responses used in this table are included in Appendix B. Some respondents gave more than one answer.

Table 9: What do you think Conner Prairie is trying to show with the exhibits in this space? (n= 65)

	Percent
Innovation and the Progression of Technology	57%
Scientific Concepts: Engineering, Energy, and/or Electricity	28%
Opportunities to Learn/Use Critical Thinking Skills	20%
How Things Work	18%
Not Sure	2%

The coded responses used in this table are included in Appendix B. Some respondents gave more than one answer.

Table 10: Is there anything in this exhibit that looks familiar or reminds you of something you've experienced before? (n= 57)

	Percent
Kitchen Appliances	28%
Wind Energy Objects	28%
No	21%
Electrification Artifacts	19%
Rube Goldberg Machine	7%
Non-Specific Object(s)	3%

The coded responses used in this table are included in Appendix B. Some respondents gave more than one answer.

Appendix A: Child Interview Data

Portions in square brackets have been edited for clarity. Responses marked with an asterisk are an interjection from a parent or other adult.

Historical Thinking – Data Set 1
(n=98)

59% of all the children who gave responses were able to articulate some level of historical thinking. The remainder did not give a relevant response.

29% (28) Described the past

The sub categories of "described the past" are included below.

15% (15) Gave a description of what the past was like (simple)

- They [people from the past] were really good inventors and it took them a long time, many tries.
- This place is about teaching people about old time stuff. And that's pretty much old time.
- [Conner Prairie wanted] to show us how what the old days would be.
- I think he [facilitator] wanted to show you how they lived in the past.
- [I was trying to get the kids] to think of the past. [parent]
- They [Conner Prairie] wanted you to think about the past and all the creations and all the- what they have been doing. All the stuff they had back then.
- [Conner Prairie wanted us to see the exhibit] So we can see old stuff and learn.
- So they [kids] can learn about the past, learn what they could make, learn what they could do.
- [Conner Prairie wanted us to see the exhibit] So we can learn how they made electricity.
- [Conner Prairie] wanted us to know how they did it [lived] a long time ago.
- [Conner Prairie wanted us] to see the way the past was.
- [Conner Prairie wanted us] to learn about past.
- That it matters, you can't see in the dark. Like, in the old times, you didn't have electricity and so Thomas Edison made the light bulb, which took him 2,000 tries and what he said when he made it was, "There's 1, 999 ways not to make a light bulb".
- [Create.Connect can help kids] learn about history and hard science.
- To show how important like history and stuff like that, and science is so important and I need to learn that, and I need to know.

13% (13) Made a comparison between the past and the present (complex)

- Well they worked a lot, not just letting everything else do it for them. Like if, say the fridge, say today they're like automatic, they just come out, but back then they had to get ice and stuff. Like sometimes new fridges produce ice from water.
- That whole wall is people from the past [Conner Prairie wanted us to see it] so we could learn how things were in the past when they didn't have electricity.
- We have come a long way in technology.
- How they got electricity, it's different then how we get electricity now.

- No iPads [in the past]!
- We have to know what it was like to live in the past. Feel what they felt.
- They had a rough time, had to cut wood [in the past].
- [Create.Connect was showing] like what they had and how they could fix it but now we just throw our stuff away. Also how things work, and how people and things were in the past.
- [Create.Connect shows] how hard the life could be cause you had to go get stuff
- They [people in the past] didn't have as much things. Like a microwave.
- People have been using windmills for a long time and their still using them today.
- [Create.Connect is about] what we could learn from the past, what was different from today in the past.
- For the same reason that we are so used to the high tech machines like iPads- I like iPads- so that we could see how it [machines] works.

31% (30) Described a historical object in the exhibition

The sub categories of "described a historical object in the exhibiton" are included below.

19% (19) Identified an object from the past in the exhibition (simple)

- The cartoon writer [Rube Goldberg].
- There was a really cool thing that was gonna hammer a nail [RB artifact]. That was pretty cool, that every year they have a competition. They gotta make something do something else….so they were making it hammer a nail using a whole lot of cool things like gears, chains, all kinds of things.
- I just learned really how easy they are [RG machines] how easy they work and how hard they are to build.
- I noticed the windmill was from the past.
- It [the windmill] kind of looks like it's been old, and since Conner Prairie is about, like to discover old stuff, so I knew it was from the past.
- James. [historical interpreter]
- Ya, the windmill. I saw it had rust on it.
- The oven.
- The fridge.
- The fridge.
- The refrigerator.
- They used that [the stove] to cook.
- I saw the old kitchen holder [stove], and the refrigerator.
- I did see the refrigerator, and the radio and that fan over there.
- The old desk lamp
- I just saw that water pump there. They took that pump and they pumped it with their hands
- The windmills. That stove.
- The stuff over there on that side, the fridge and windmill.

11% (11) Used an object to articulate a difference between the past and the present (complex)

- There was no electricity [for the fridge] in the past.
- The lamp. They didn't have much light [in the past].
- The stove, it was different [from stoves now].
- I learned that refrigerator over on the side, you have to pull back the thing, and then there's a little tiny freezer… and they're different. There's actually another fridge [today] but it's cut down in the middle. Freezer. Fridge.
- There's a stove where you had to put wood in the bottom. Nana told me that.
- I saw the circuit thingy [the fuse box]. Dad said it reminded him of the one at Fayetteville, our old house.
- [The fridge is different because] it's smaller, you put less food in there. The stove is bigger,, more up on the top. It has more compartments [than today's stoves].
- [People in the past] had to use it [the windmill] as a fan or electricity. Today we use regular… batteries.
- The stove, windmill. They [showed us that people in the past] didn't have electricity.
- So we can learn more about science and more about the past.I think we have to know everybody that lived in the past and know what it was like to live in the past. And feel… what they felt. *It also teaches you how we've advanced from what we started with. We started with cramming wood in a stove and burning it for hours to make our dinner. Now, with the improvements of electricity, we can go and just flip a switch and our stove heats up on it's own. We don't have to cut wood. We don't have to put it in there We don't have to set it on fire. Ma' maw used to manage an apartment building that had these little metal boxes, and stairways in the back where they used to bring a big block of ice and stick it in there. You had to buy them. And then you would take that block out in your kitchen and put it in your refrigerator. And those doors were still there.
- I could build something that could one day become a something to the world. [like the RG artifact]

STEM Thinking – Data Set 2

n=105

50% of all the children who gave responses were able to articulate some level of STEM thinking.

14% (15) Gave a response about circuits

The sub-codes for "gave a response about circuits" are below.

4% (5) Identified electricity

- That little electric thing, it showed you how to wire your house. I did it. That electric house thing. That's pretty much the only thing I can actually make something go [interact with].
- Well I was checking out the DC and AC circuits or whatever they were and on the DC I couldn't really figure out, I did it the way it said but the light wouldn't light up, but on the AC I managed to do it, to make it work. I even discovered something else cool; so there were two lights that were flashing and whenever the- if you turned the dial one way, whenever the left one lit up the lamp lit up and if you flipped the die over to round, when the right one lights up the lamp lights up.
- Inventions! I made electricity and wind. I'm gonna fix our doorbell [at home]. Daddy has some [alligator clips] like that in the back of the suburban. I can go home and know how to fix a doorbell!
- I figured out electricity. I made a light turn on. [My favorite part was] where it lighted up.
- [I learned] how electricity works. Electricity can be generated in different ways.

8% (8) Talked about connecting wires, batteries, etc, to make the activity work

- I figured out at the circuit that you have to connect everything to make everything [the electricity] work.
- [I learned] That if you connect the wires to the batteries and the box, the white box, it would make a noise. And if you connected the one thing- the farmhouse- the battery to the farmhouse it makes light.
- [In Create.Connect] you can learn how to snap circuits and make things light up.
- You have to have a plus and minus ground [at the circuit bench].
- You have to have both of the circuits. Plug them both in to get the bulb to work.
- It was just connecting the red string to the red house of string- red wire… and grab a black wire to connect it to the different color.
- You have to connect wires. I connected them to go on.
- Yeah, you've got to connect wires to wires, and you have to make stuff do stuff you can get it.

2% (2) Identified that a circuit is a circle

- I figured out that you have to have a complete thing, a circle before it works.
- [I figured out] That it [electricity] goes in a circle.

14% (15) Gave a response about wind energy

The sub-codes are included below.

6% (6) Talked about wind energy

- *You were telling how you made energy with the wind.
- I can make electricity [with wind].
- I figured out how to make electricity. Taking a cardboard fan, and then making a fan blow on it and then I powered both the houses.
- We made one of those [windmills]. It spinned all by itself. *Does wind create energy? Wind creates energy.
- Wind actually makes electricity.
- [I was] trying to make the windmill blades in the correct position to make electricity generate. Like, if you just had them straight, it wouldn't really work so well, it would just go slow so your lights wouldn't work as well. So you needed a way to make it go kind of faster, so you can have light source for longer.

8% (9) Talked about how blades affect wind energy

- I was making- figuring out which [blade] was most efficient.
- I learned that they can't all be facing the same way. There's different types of windmills. You have to turn them towards; they're kind of like that.
- We also liked going in there [wind bench] and trying to get the wind speed past 100, but it didn't really work out. We thought the first one would do more because the wind would come and hit against it and then it wouldn't move. [demonstrates different angles with hands]
- We tried two different fan blades but it didn't work.
- If you turn it on, it will go. And then you turn it off. And when it's going really fast, you can turn the fan off and then it… stops. *And also what'd we find out about if you turned the little things? It goes faster.
- I was thinking about the question which blade style would work best and the square would probably have more surface area so I started making logical decisions about which one I would make next. I wasn't like testing it though, but I was kind of like…[thinking about it]
- I did three blades and once I did two. The number two one went [pantomimes spinning]. The number two one, red and blue.
- I looked at the dioramas and the blades were perfectly aligned. Mine weren't
- If you leave an even number [of blades] it works better.
- [I was] trying to make the windmill blades in the correct position to make electricity generate. Like, if you just had them straight, it wouldn't really work so well, it would just go slow so your lights wouldn't work as well. So you needed a way to make it go kind of faster, so you can have light source for longer.

21% (22) Gave a response about simple machines

The sub-codes are included below.

4% (4) Talked about the end goal of the ball run

- The small ball was supposed to knock down the dominoes and the dominoes were supposed to roll a bigger ball.
- We didn't finish. We fell just short; I had to give it a slam-dunk.
- We had to get the ball from one end to the other.
- We were trying to get the ball to the finish; I learned that it's not easy.

6% (6) Talked about multiple steps in the machine or strategies for success

- I had to push the part and the catapult zoomed forward and while the thing was spinning it hit it [the wind chimes]. It went up, down, fell into a big hill, fell in the catapult, hit this one and it hit that.
- You know what I was trying to build? I was trying to build a hammer to try to knock the ball and then it would go up and then there would be another hammer to try and kick it to… bounce to another… hammer and it would go… and then… hit the ball…and that's it.
- We put the ball right there and then it went like that- we pushed the ball and it went like that and there's a wind thing- we used that black thing, and then it fell out and hit the thing, and that made the ball go up, and then it went down the hill thing and hit the hammer, the hammer moved and it hit the two pieces of wood…
- See, the ball, we put the ball and a ramp so that the ball go'd down it, and then it hit the ball thing and then that knocked down the dominoes, and then someone else came and knocked down the tower.
- [I learned] that you could do it many different ways… that you can get it to where you need it to be faster. And there are other ways that you can do it.
- I was trying to make a four step mallet hit a wind chime to make it ring and I tried to build something so that it could either knock the ball or I could just drop the ball which would hit a see-saw or something and then make something push up which would make the stick lose it's balance and then the mallet would fall and hit the wind chime.

7% (8) Talked about the properties of a simple machine.

- [I figured out] that we needed a stable ramp and it had to be wide not narrow.
- The smaller ball that knocked over the dominoes, it was smaller than the bigger ball that knocked down the cups.
- [The ball] it will roll, except it needs a lot of power.
- Oh we figured it out, but we didn't know what position. There's like this tower where we had put the tennis ball but we had to have in the right thing because we could only use our hands twice, so if we could push it up then it could fall down into the cup, get the weight down and then the ball would go up and then go into the cup. So we had to get the right angle for the teeter-totter.
- The ball didn't have enough power to take the cups down I think maybe if we would have put a little more power into the last ball it would've knocked over the cups. But the small ball was supposed to knock down the dominoes, and the dominoes were supposed to roll a bigger ball!

- That the ball can't just go straight down, it has to have some hills to it because if it just goes straight across the cardboard it will eventually stop and fall, but if you have some hills and stuff to go up and levels [fulcrums] it will go all the way.
- [I learned about the machine] how to move the ball up and down.
- **E**ven though they're called simple machines, they're pretty hard sometimes.

4% (4) Talked chain reactions

- My friend and I made chain reactions. If you do one thing it can make other things happen.
- I had some chain reactions. *You learned that if you make one thing go then what happens? The rest of the things go.
- Well you have to make stuff to hit this, in very interesting ways. This is a weird machine.
- We were trying to make a chain to knock the tower down, in five steps.

Appendix B: Adult Interview Data

The following data sometimes includes edited responses. Portions of responses in square brackets represent an edit to the original comment to help distinguish the point of reference, since comments were often excerpts of group conversation and/or multiple responses during the interview. Combined percentages do not come to 100% because out of 60 comments total, most were part of longer statements made in response to one question. The percentages are derived from the code's *n* divided by the total *n* for responses to each question.

As a parent what did you like or not like about the exhibits in this space? (n=60)

48% (29) Interactive Components

- I like that it's hands-on, interactive.
- This whole interactive thing is really nice I think.
- As a grandparent, I liked that it's interactive, that's very nice and they can discover things.
- I liked that it was very hands-on and they could understand what they were learning.
- I liked the interactive, that they got to hands-on make the windmill.
- I liked it. It's engaging and it allows kids hands-on stuff, which is good for mine!
- The fact that they're so interactive is wonderful.
- I love that it's all hands-on and the kids got to kind of do their own thing and build their own things and use their imaginations.
- I liked that they can play with the stuff freely and it's not just like a "look at it and don't touch.
- I like that it's hands-on and I like the fact that they can experiment and get in there and touch the tools.
- I liked that it was hands-on.
- I thought it was cool; I liked the interactive part.
- Hands-on, and the step-by-step, he's fascinated by electricity so the direct feedback of making the light come on is great.
- Actually my son really enjoys the electricity part and the windmill, not my two year old…there's not a lot that she can do hands-on without a lot of help…but I realize you know it's hard to get that whole [age] span.
- I really liked how they were hands on and interactive.
- I liked the hands-on experience.
- I liked that it was hands on. You could actually play with stuff, not just look.
- Well, like, it's incredibly hands on, which as young kids are real kinesthetic, and that's really how they learn best.
- I liked the hands on. She's able to do the windmill.
- I liked the interactive part of it.
- A lot of hands-on stuff for the kids
- It was interactive, hand's on, well-crafted, thought provoking.
- I like that the kids are free to create their own stuff.
- They really liked lighting the light bulb, connecting power etc.
- Hands-on is fun.

- The wind turbine with the different blades was really good, because they got really engaged with it.
- I thought the whole windmill thing was kind of cool, to see it working, some people playing with it and how it generated electricity, so I thought that was neat.
- That's what I liked about the picture things on the little table over there, because he could follow the instructions and create something.
- There seems to be plenty for them to play with.

37% (22) Opportunity to Build Knowledge

- I liked it because it looks educational.
- I liked the creativity and the fact that it made kids think.
- Teaching about the history of electricity and different ways to make electricity other than coal.
- I liked it all, I liked the electric, how she got to learn about it and make it turn the light switch on.
- Well, probably that they learned something about electricity, and the windmills. You know it's a new concept to them, so this is an opportunity for them to build knowledge about something new.
- The facilitators explained everything and they were really good working with the kids.
- My son's five years old, the facilitator was able to take his answers and make them make sense to other projects.
- I liked her [the facilitator] interaction with the kids, she just kind of drew them in, didn't really give them answers just pushed them [children] forward to really experiment and have a good time. My kids really enjoyed it.
- We really enjoyed it. It was fun. We learned a lot. The chain reaction was probably something that they enjoyed the most.
- (As a) Grandparent, I liked that it's interactive, that's very nice and they can discover things. And the people that were chaperoning here, they kind of give the kids enough to get started on and then kind of let them discover.
- I thought it was really creative. There really wasn't anything I didn't like. I liked that it was very hands-on and they could understand what they were learning.
- I like that it's hands-on and I like the fact that they can experiment and get in there and touch the tools.
- He's fascinated by electricity so the direct feedback of making the light come on is great.
- Just for them to be able to spend as much time as they want learning about those things for themselves.
- Well, like, it's incredibly hands on, which as young kids are real kinesthetic, and that's really how they learn best.
- The original windmill that you had there from period, from 1891. We didn't talk about it much, but just to show where they got their power from.
- I thought the ball thing was pretty interesting, how stuff works.
- I love the fact that you can teach the basics of electricity.
- For the little ones, having a model to follow, then maybe they can move on from there and do something on their own.
- I liked that he could get a lot of things at his level, a lot of fun things liked that the bigger things that were more involved were up above his level, was good
- I liked that it was science stuff, because my son likes that.

32% (19) General Praise

- I liked [the activities]. I thought they were good.
- Well I liked everything. I thought this was neat.
- I don't have anything bad to say about Conner Prairie. They change all the time and it's great that they have different exhibits going on.
- I liked it.
- I loved it.
- It was good.
- I liked everything.
- There's really nothing I didn't like.
- It was really fun.
- We really enjoyed it. It was fun.
- There's nothing I don't like, it's just fun to be able to go around and be able to get exposure to all the different things.
- There's not anything I don't like.
- My kids really enjoyed it.
- I think it was fantastic, it was really great.
- There wasn't anything that I didn't like.
- I thought it was cool.
- I liked…pretty much all of it, really.
- As an uncle I think that this is an absolutely cool display. There's a lot of really interesting stuff.
- I think it's really neat, the variety that there is.

30% (18) Specific Component or Activity

- I thought the oscilloscope was cool, to show them about electricity. That's something I work with everyday.
- The wind turbine with the different blades was really good.
- I thought the whole windmill thing was kinda cool.
- The windmill is good for the kids to play with.
- I thought the ball thing was pretty interesting, how stuff works, this thing especially [RB bench].
- It was kind of neat to see some of the experiment benches.
- I like the fan set up.
- The windmill thing.
- On the wind turbine, there was good information, step by step, so you could figure out how to do it and the written information. So that was very helpful.
- That's what I liked about the picture things on the little table over there [wind activity].
- She likes the old stove, stuff like that. We liked the electric but we couldn't get any of the lights to work, so, change the light bulbs!
- I liked the electric, how she got to learn about it and make it turn the light switch on.
- Teaching about the history of electricity and different ways to make electricity other than coal.
- Actually my son really enjoys the electricity part and the windmill.
- The direct feedback of making the light come on is great

- I think this was the most fun for them I think [RB table] but they really liked lighting the light bulb, connection power, electricity to make something happen and the table over there was fun.
- The chain reaction was probably something that they enjoyed the most.
- I liked the electrical exhibits with the wind, I thought those were pretty neat. I liked the fact that you have gauges so you can see the wattage and rotations per minute and all of the different mechanical set-ups here at this table specifically are pretty cool.

23% (14) Facilitation from Interpreters

- Actually I thought the people working it [facilitators] were awesome. They knew a lot- explained about everything and they were really good with the kids, helping work with them.
- Well I liked the folks that are helping out.
- He [facilitator] was able to level that activity toward my son. He did a really good job gearing that down for a younger child. He did a really good job.
- I liked her [the facilitator] interaction with the kids, she just kind of drew them in, didn't really give them answers just pushed them forward to really experiment and have a good time.
- I did like the interaction with some of the workers [facilitators] it was good. They weren't like- it wasn't too overwhelming, they were kind of in and out, that was good.
- I liked that there was someone there to go around and tell us the different things to do instead of being self-guided.
- [The exhibit was] well-crafted.
- The people that were chaperoning here, they kind of give the kids enough to get started on and then kind of let them discover.
- I like that there was a docent there to get the kids engaged.
- Obviously they need someone here to explain this, because we can't!
- It's engaging and it allows kids hands-on stuff, which is good for [my kids].
- I liked the very helpful suggestions of what to do [from facilitators]. Like, what do you want to do and I'll help you on it.
- I liked that there were people there to explain it, you know that it wasn't just sitting there and then you're trying to figure out what did they want the kids to do with it, that there was someone to talk them through it. Especially having three of them, it helps [to have facilitation] because then they're not waiting for me to come and figure it out myself before I can then tell them
- The wind turbine with the different blades was really good, because they got really engaged with it [facilitated]. The other one that you did was kind of complicated, getting the ball to go into those different places [not facilitated].

13% (8) Layout and Variety

- I liked how there's space, and from sitting here I can pretty much see where they are. A little blockage right there but not a big deal, there's another seat over there. So your seating for the parents are pretty well spaced.
- I liked all of the different mechanical set-ups.
- It was open enough, cause you can see your kids from all sides; you could let your kids be a little free. I liked that you could keep your eye on them from one side to the other. That's a big plus. And it's open enough that it's not over crowded.

- There was a ton of stuff, which was nice. At first I wasn't sure if it was open to everybody or if it was just for a [private] group thing.
- It's just fun to be able to go around and be able to get exposure to all the different things.
- She likes being able to do the different little things.
- There seems to be plenty for them to play with. They're not competing for the same things, there's multiples.
- It's very nice and open.

5% (3) Negative/Other

- I could use some more instruction… either somebody telling and answering questions or providing information or just kind of a laminated thing on the table about how to connect the circuits. We did one and the light worked, but then when we did the buzzer one it for some reason didn't work.
- I think the problem is we're passing through here and you didn't really explain things, for instance we were trying to do the something here with electricity and we didn't have any instructions so how could we know- we had to give up because we didn't know what to do. The wheel thing had a little instruction and I think that's one thing for them [children] to do. I mean mostly there's the 1, 2, 3 here's what you do but this thing over here, we were sort of wondering what to do.
- We honestly didn't look. We were standing talking while they were playing.

What do you think Conner Prairie is trying to show with the exhibits in this space? (n= 65)

57% (37) Innovation and the Progression of Technology

- I guess innovation. We were here before, it's got all just kind of circuits and all kinds of innovations
- When we went to Prairie Town and we went through the signs it was, "No cell phones, no TV's, microwaves" and all that and this is tied in. If you needed energy from something, this is how you got it, from the wind, so it wasn't that you just flipped on a switch and got it, it came from somewhere
- Basically how things work, how they got things to work before. [in the past]
- Progress.
- Science has been around for hundreds of years.
- Basic physics, tools, simple tools, you our kids are so used to high tech things that they can't see how they work, so it's cool to see things at a much more simple level, as they would have been in the past, but in a way that kids can interact with it.
- The past and how things were.
- Probably how far we've came with technology.
- How things used to be. Everything was pretty simple, you could make all this yourself versus the factories and everything all the technology comes from now.
- That when energy is old, and it's been used for a very long time it's not a new thing. Right? And that it creates energy.
- Just the efficiency of- I don't know. It's our first time here but we've really enjoyed it, just of how they did it back then. Nowadays things are so modern we never realize the things that they had.

- I think that it's trying to teach people not to take electricity for granted, that it wasn't always there.
- Science in the past how much it's evolved into the future, because you just don't have time to stop with kids and read all the stuff that's there. You gotta get to it and then go, quick.
- Progression.
- Alternative, maybe wind. You know, wind alternatives to fossil fuels. But then also just from the historical perspective.
- Just how we've gotten from this to that [past to present]. And then just experimental things, how they were made.
- Probably like the evolution of things, like electricity, like how things have changed over the years, I'm guessing. We didn't get through the whole thing, just the beginning part. It looks like electricity and the ways people used to do things that were harder- ya, technology.
- To show our history, how things came about.
- I would say how things have changed through time, maybe give an example of technology and how it was invented.
- How electricity started really.
- Putting it to practical use, especially with this being a rural area, there's a lot of self-reliance and utility.
- I think just history, sort of how relatives long time ago used to have do the things it takes us a short time to do now.
- How things were back in the day, how electricity works and how to put stuff together.
- How in the past the way things used to be, and what they are now.
- I think it's kind of talking about how technology makes our lives better.
- To have hands on, to experience some of the things from the past. Thinking about how to create the projects.
- It's a way to show how back 1700-1800's that in this case simple machines played a role. The windmill exhibit – how they used windmills to do what it was they needed to do, and that it wasn't anything that needed to be hardcore science, like what we have now, but that people even 200-years ago could use a windmill to draw water or mill flour
- I think how… what a difference made in our lives, and how it's made. Because we're going out and seeing that we don't have all of this.
- I think it's just showing the science being alternative energy and how it's not necessarily a new thing.
- Just getting the kids to understand what it was like and how much things have changed over the years.
- I would say that it's like science, this is more science based, this time around, cause I know that this changes out all the time [the exhibit space]
- Maybe the beginnings of electricity or tools. I noticed the wind exhibit. The beginnings of [engineering] sorts of things.
- Just the fundamentals of how things work back in the old days kind of I guess.
- I would say how things have changed through time, maybe give an example of technology and how it was invented.
- How things were back in the day, how electricity works and how to put stuff together.
- I think it's just showing the science behind alternative energy and how it's not necessarily a new thing.

- I think just history, sort of how relatives long time ago used to have do the things it takes us a short time to do now.

28% (18) Scientific Concepts: Engineering, Energy and Electricity

- I think it would be the use of energy, or how to design- designing and use in engineering.
- Some of the more basic scientific things- just kind of like what you might see out- just different things you might see out in the Conner Prairie world. Like how the, just the fundamentals of how things work back in the old days kind of I guess.
- I think that they're taking some history of various items of science and giving the kids hands-on so that they're learning science and history. There's history in it.
- Science- I mean just how the science behind it works.
- Engineering.
- Here it's just physical science- gravity, electricity, motion.
- They're trying to show the science but also make it fun and interactive.
- Education and science. We were just talking about this since I'm a pre-service teacher, so I'm looking at all the standards that we're covering and here is great, great, great!
- Constructions, energy.
- I guess it'd be a place for learning mechanical engineering or electrical engineering skills, basic skills, or promote kids to enjoy science more.
- The big idea is engineering, trying to build an interest in kids' own design, which is great.
- I would say that it's like science, this is more science based.
- Alternate energy, and how we can harness the wind.
- Simple engineering and design can be functional.
- I like this complicated machine because you can make mechanical things. I like this.
- With this particular exhibit, more of a engineering type set-up and getting kids to figure out how to use different things.
- Basic physics, tools, simple tools, you our kids are so used to high tech things that they can't see how they work, so it's cool to see things at a much more simple level, as they would have been in the past, but in a way that kids can interact with it.
- I believe it might be energy. How energy flows, and uses energy. How it can be harnessed to make something move.

20% (13) Opportunities to Learn/Use Critical Thinking Skills

- Solve puzzles.
- Getting kids to figure out how to use different things.
- Maybe just ingenuity, just figuring out how to do it and then using that to solve problems now.
- Cause and effect or, relationships with how you're building things.
- Opportunity to get a hands-on experience of design.
- That is great for thinking skills but it was a little too difficult.
- Thinking about how to create the projects.
- I think it's just enhancing the learning process for them, hands-on discovery and that sort of thing, which is good, it's one of the reasons we like coming here.
- I guess it'd be a place for learning mechanical engineering or electrical engineering skills, basic skills, or promote kids to enjoy science more.
- Like, to use your brain to get things work.

- Just education in general I think.
- I don't know. Just hands-on learning for them.
- Probably just education.

18% (12) How Things Work

- How things work, putting together things, how things work.
- Maybe just how simple things really are.
- Basically how things work, how they got things to work before.
- How stuff works that's part of it.
- If you needed energy from something, this is how you got it, from the wind, so it wasn't that you just flipped on a switch and got it, it came from somewhere.
- Like, to use your brain to get things work- I don't know.
- Showing them how it's made and how it works.
- How things work back in the old days kind of I guess.
- Well, along the lines of electricity and how the windmill works is really cool.
- Our kids are so used to high tech things that they can't see how they work, so it's cool to see things at a much more simple level, as they would have been in the past, but in a way that kids can interact with it.
- Just how we've gotten from this to that [past to present]. And then just experimental things, how they were made.
- How things were back in the day, how electricity works and how to put stuff together.

2% (1) Not Sure

I don't know really.

Is there anything in this exhibit that reminds you of something you've experienced or thought about before? (n= 57)

28% (16) Kitchen Appliances

- Ya, being on old farms, old appliances. I think that's about it.
- The appliances, how they're similar but different than now.
- Of course obviously recognizing electricity from home.
- The refrigerator.
- The fridge.
- Yeah, the freezer. The freeze box.
- Yes, we have actually the stove back in the corner is something we grow up with. We had a little water heater in the side we used to heat our water with and stuff like that. That and the waffle make and a few things like that.
- Ya actually some of them from great-grandparents house kind of stuff growing up, so the stove was kind of neat, I think I've seen the refrigerator style a long time ago.
- I noticed the fridge and I looked at the stove and I kind of peaked in the little cases, but I didn't get a good look at it cause he wanted to go over here.
- The stove, my mom and dad had one like that.
- I think the old stove and fridge are fascinating and I just have a love of history and think it's pretty neat.

- I loved the stove and the iron and all that because I figure my great-grandmother probably had those things.
- The iron, the stove, we have some antiques around in our family, I mean not the stove but I knew what some of it was. I'm not any good with the electricity but they are.
- The waffle irons.
- I've seen waffle irons.
- The refrigerator.

28% (16) Wind Energy Objects

- My grandparents had a windmill like that in their backyard!
- I mean I've seen windmills and stuff like that.
- I always see these [windmills] on farms and I always wondered why they had them and they serve a purpose, the windmills. So I guess I never really knew I just thought they looked cute on farms!
- The windmill.
- We saw the wind farm when we go up to Chicago, we've seen that. And I've seen windmills.
- Outside of a museum? A windmill might be the only thing.
- The windmill was one of the panels I was looking at, the different windmills, something that's kind of familiar. But again I hadn't seen all of the different kinds.
- I liked the windmills; I thought that was very educational.
- I know I've seen those windmills before. It was neat because somebody sat with [my son] and explained it to him while the other two were doing windmill and he really got it. So that was really neat. For a five year old I thought that was good!
- The windmill, there was one at my grandparents' house.
- We're both teachers, so we can relate to with the windmill and the water pump and those kind of things.
- In particular the concept of the windmills, I personally was kind of drawn to that.
- The windmills- the bigger windmill.
- Yeah, the fans.
- Oh yeah. I've definitely seen windmills before.
- The windmill.

21% (12) No

- Not right off hand, no.
- No, not really.
- Not really being able to get hands-on, able to make- in that way it's very different
- No, not really.
- I don't know, I didn't look around that much. I only pretty much stayed at the two tables so I didn't even circulate the whole thing. Because I kind of tend to go where my kids go and if it's something that's interactive, that's where they're gonna go. They're not gonna go- they're probably not gonna go look at the stove. And they're boys!
- No. I mean, I recognized the perception behind it but, no.
- I didn't really look a whole lot, but no. Not from what I'm seeing, no.
- Not really, no.
- No.

- No not really, not especially.
- I don't know, not really. Besides the balls, no.
- I didn't get a chance to read every detail about every exhibit last time. This time I read the descriptions with the pictures. I liked those.

19% (11) Electrification Artifacts

- Yes, well I'm an engineer myself, an electrical engineer so… [children begin to fight] it's just putting things together, it's the different electrical meters that's pretty neat.
- The electrical box, the old fuses and stuff, ya I remember those.
- The Meters. We just took an old one down, out of a barn.
- The artifacts like the old lamp and stuff over there? Yeah, I noticed it, but I wasn't looking at it. You kind of bypassed it, I kind of looked at it.
- Ya, I know the oscilloscope and some of the other things, the radio, that stuff. I mean I wasn't paying attention to all that, because I was just paying attention to wherever they were going.
- Ya, a lot of it does. The telegram because he did that for a science fair, a science project last year. The old refrigerator, I remember a refrigerator like that at my grandparents' house.
- The electrical meters and that sort of thing.
- The electric works and stuff like that….like how it works with the AC/DC and stuff, the meters.
- I guess I thought the electronic connection thing was kind of neat because I took an electronics course in high school. I liked connecting the wires.
- I used to teach high school science, so ya, quite a bit actually! Doing the circuits, obviously there's a lot of things there I'm familiar with.

7% (4) Rube Goldberg Machine

- Well going to a lot of different museums and kids oriented things, I kind of recognized that you're kind of building a Rube Goldberg machine.
- The Rube Goldberg machine. We were studying that in science. From simple machines. I remember that from way back when I was in school.
- We were talking about the machine over there, we both went to Purdue and they always had Rube Goldberg teams. We were talking about that a bit.
- Obviously the Rube Goldberg exhibit. That's identifiable.

3% (2) Non-Specific Object(s)

- They all relate to- it's not a fair question- I'm a science teacher, so it's… real things.
- Ya, most of it (the objects), in the real world.

While your child was in the exhibit what were you trying to do? What was your role? (n= 59)

This question was not coded and all the responses are included below.

Answer questions if they had any, help them out.
Figure it out, with her.

Have a good mix between letting them just explore on their own, but also… like my almost six-year-old, he wanted to a lot of it, but I knew he needed a little more guidance. Getting that right balance between letting them discover it on their own but kind of helping them to actually create something that works.
He was doing probably 95% of it, and I was just giving him maybe a word or two here or there. But he pretty much did it on his own. Making sure this one [CF] didn't run off with any tools.
Help her. I was just following her lead. If I saw her get stuck I just nudged her a little in one direction.
Help them engage in the process, and I was also learning. I think it's fun to see their minds work and see the connection, the light bulb go off so to speak, and their excitement when it happens. I think we were doing both.
Here, together. She was doing it mostly herself, she can do it.
I just basically walked through with her. Like I said, it was probably a little bit too old for her and just, she would prefer the craft section.
I just kind of tried to step back and let her try stuff. At the electric table I was helping her hook stuff up but everywhere else I just let her try things. Because I don't know that I'm any better at building a Rube Goldberg machine than she is.
I was just looking around but playing too. [said both worked independently and together].
I was just taking pictures of them.
I was just trying the same activities.
I was just trying to be hands-on in being there so they can learn and also, I don't know, just be a part of a good experience. I'm a very hands-on mom, I try to help them learn and I'm learning and they just see that it's a positive experience. So, they're not as scared to try it.
I was just trying to teach him more about circuits. I was just trying to teach him that electricity has to have a complete pathway. I was trying to talk about the difference between AC and DC current, but… He's going to be an engineer, I think. I hope so.
I was kind of playing too. I was trying to help them but then when they were doing their own thing I was just playing with the dominos and stuff. Oh ya, Dominos! That's another thing I recognized.
I was like, "Try the other pillar" and then I was doing it afterwards!
I was sitting beside him. I was looking at other things and messing around with him too. We did the first one together and the he was kind of doing the next one by himself.
I was trying to help her and also trying to read some of the labels and information. I barely passed physics in college so… I couldn't help her, and there were no instructions. So we didn't get that one at all
I was trying to help him
I was trying to read the descriptions and the theory behind these objects. I was working for her [child].
I was watching them, and seeing how they were taking everything in. [said they worked independently and together]
I was watching them. I try to let them do the problem solving themselves, I think they learn more that way, so I was just standing back and watching.
I wasn't. I like in this case when the four of them were there, I didn't want to get involved so that the four of them could work together and figure it out by themselves without me coming and showing them. So I kind of let them do their thing.
It was kind of relaxing, I really didn't have to do as much. Those people did! I really didn't have to jump in I was just taking pictures.

Just giving her suggestions with the things she's working with, maybe how she could put it in a different order, maybe to help it work, which we didn't succeed at yet but, that's basically why I did. I tried not to help too much just so that she could try to figure it out herself.
Just help her and guide her.
Just play with him, help him think for himself, let him try to discover new things. I was trying to, more or less, show him different ways of learning. Help him to solve the puzzles or figure things out. I'm the role of the parent, so it's hard to put that into one definition.
Just playing with them too. [stated worked both together and independently]
Just sat and watched.
Just sitting next to them. When they were playing… I helped the younger one and then I helped her light up all the houses all together.
Just talking to her about it.
Just watch, watch what they were doing. [said they both worked together and independently]
Just watching her and her dad. Her and her dad were working together, ya.
Just watching what they were able to do with their imagination or their knowledge and see how they work with what was there.
Just watching, and kind of looking around at some of the things as well.
Just watching, she [child] did it.
Just, they would both separate, and just making sure that they were behaving.
Keep our eye on them, try to help out as much as possible but yet let them figure it out on their own. They [CM and AM] together and a little independently too.
Letting him do it. He didn't ask for help, so he didn't get any. But, you know we learn by doing.
Make sure that he wasn't breaking it. That's what I was trying to do.
More just kind of watching how they interact. Just kind of helping guide them and lead them.
And watching the process. How to figure it out. What would be the next step. Role of more of a coach.
Mostly I just listened back and forth and watched and then that way I can kind of explain to them. But I was just listening to how he [facilitator] was explaining the windmill and then helping him understand that it was causing pressure on that. And then with- I was kind of watching with Joel [CM] cause I was trying to kind of see what she [facilitator] was doing so that when he was into it I could figure out how to help him with it.
Part of it we were learning with them! But just as a guide to kind of educate them while they were trying to learn something. So more of a guide I guess.
Playing a little bit but then also I was watching, I was reading some of the posters around the exhibit and actually I watched a couple of the Goldberg science shows on the Purdue screen there. I was trying to help them, but then I tried to build my own, a couple of times.
Really help show him that the whole process from a source of electricity through a switching mechanism or a circuit and then to the final [indistinguishable] section or whatever he was trying to get to. He build some circuits that were actually shorting and I tried to show him that because he didn't have a circle he was creating a connection that wouldn't generate an outcome that he was looking for.
Teach them all we could while they were interested in playing with it.
To assist, we were playing too! We were having just as much fun as he was. Not much past that. We were just doing the same thing.
Watching them. How they related with the…
Watching. A little bit of both [working together and independently]. I was mainly watching though.

We just set it up for them so that they could experiment and learn on their own. We just tried to let them figure it out for themselves and guide them when we could. Worked independently, but gave guidance.
We kind of watched, talked them through what they were doing. A little bit of both [working together and independently] I mean they would do something and I would say, "What do you think's gonna happen if you do it that way?".
We was just kind of standing there next to them, watching them do it. Just kind of listening to that guy, it was pretty neat.
We worked on the ball run [together], and then I went and stared with amazement at the Rube Goldberg.
We're hands-on mammas! We're doing it too! Taking pictures. Cutting the circles.
Photographing. Helping them, asking questions. Facilitate and observe, because we helped them cut the circles.
Well, trying to help him adjust things to make it allowable. Watching him play and trying to help facilitate.
When he [facilitator] gave us the timer to make the blades I was just trying to talk to the kids, get them involved and make blades and help with the activities.
When he was doing the circuit table I was helping him do the circuit table, and when he was doing the Rube Goldberg thing I was messing around with that other thing right there.
When he was doing the circuit table I was helping him do the circuit table, and when he was doing the Rube Goldberg thing I was messing around with that other thing right there.
Yeah, tried to help him so we can all put our minds together and create something that seemed like it was going to work. We tried to figure out together what pieces need to be put together so we can get something working. A simple mechanism where the ball can go through various curves and we can build some knowledge.

Appendix C: Table Data

Table 11: Frequency of Time Target Child Spent in Create.Connect (n=91)

	n	*%*
Less than five minutes	25	27%
More than five minutes, but less than ten	20	22%
More than ten minutes, but less than fifteen	20	22%
More than fifteen minutes, but less than twenty	8	9%
More than twenty, but less than twenty-five	8	9%
More than twenty-five, but less than thirty	2	2%
More than thirty, but less than thirty-five	3	3%
More than thirty-five, but less than forty	2	2%
More than forty, but less than forty-five	1	1%
More than forty-five, but less that fifty	1	1%
More than fifty, but less that fifty-five	1	1%

Table 12: Frequency of Time Target Child Spent in Exhibition, by Facilitation Condition

Minutes	**Costumed** *n = 31*	**Blue Shirt** *n = 30*	**No Facilitation** *n = 30*
> 10	39%	37%	73%
10 – 19	32%	40%	20%
20 – 29	19%	10%	3%
30 – 39	3%	10%	3%
40 – 49	3%	3%	0%
>50	3%	0%	0%

Table 13: Median Dwell Time and Interaction with a Facilitator

Circuit Table

	All *(n = 40)*	
	Facilitation	Time
Yes	40%	0:06:57
No	60%	0:01:47

Circuit Bench

	All *(n = 25)*	
	Facilitation	Time
Yes	8%	0:08:03
No	92%	0:01:19

Wind Table

	All *(n = 35)*	
	Facilitation	Time
Yes	43%	0:06:00
No	57%	0:00:23

Wind Bench

	All *(n = 17)*	
	Facilitation	Time
Yes	6%	0:06:23
No	94%	0:01:57

Rube Goldberg Table

	All *(n = 52)*	
	Facilitation	Time
Yes	29%	0:11:39
No	71%	0:02:10

Rube Goldberg Bench

	All *(n = 40)*	
	Facilitation	Time
Yes	13%	0:09:55
No	88%	0:01:12

Table 14: Frequency of Time Target Child Spent in Exhibition by Gender

	Boys		**Girls**	
Less than Five minutes	17	30%	8	23%
More than five minutes, but less than ten	13	23%	7	20%
More than ten minutes, but less than fifteen	10	18%	10	29%
More than fifteen minutes, but less than twenty	4	7%	4	11%
More than twenty, but less than twenty-five	7	13%	1	3%
More than twenty-five, but less than thirty	0	0%	2	6%
More than thirty, but less than thirty-five	1	2%	2	6%
More than thirty-five, but less than forty	2	4%	0	0%
More than forty, but less than forty-five	0	0%	1	3%
More than forty-five, but less that fifty	1	2%	0	0%
More than fifty, but less that fifty-five	1	2%	0	0%
TOTAL	56		35	

Table 15: Dwell Times by Gender and Facilitation

	Boys	Girls
Costumed	***n= 15***	***n= 16***
Min	0:01:06	0:01:30
Max	0:52:00	0:32:50
Median	0:15:01	0:10:13
Blue Shirt	***n= 19***	***n= 11***
Min	0:01:09	0:03:38
Max	0:36:18	0:43:23
Median	0:08:30	0:14:01
No Facilitation	***n= 22***	***n= 8***
Min	0:01:06	0:02:06
Max	0:35:04	0:12:28
Median	0:08:24	0:05:44

Table 16: Median Stop Times at Bench and Activity Tables, by Gender

	Circuit Bench		Circuit Table		Wind Table		Wind Bench		Rube Bench		Rube Table	
	Boy	Girl	Boy	Girl	Boy	Girl	Boy	Girl	Boy	Girl	Boy	Girl
	n=19	*n=6*	*n=21*	*n=19*	*n=21*	*n=14*	*n=10*	*n=7*	*n=26*	*n=13*	*n=29*	*n=23*
Min	0:00:06	0:00:03	0:00:03	0:00:55	0:00:05	0:00:13	0:00:06	0:00:50	0:00:22	0:00:06	0:00:28	0:00:39
Max	0:14:39	0:08:18	0:23:59	0:20:35	0:15:11	0:10:52	0:07:41	0:06:32	0:09:55	0:14:54	0:52:00	0:27:07
Median	0:01:30	0:02:25	0:02:08	0:03:50	0:01:00	0:01:05	0:01:44	0:02:13	0:01:12	0:02:02	0:02:38	0:03:15

Note the small n in some cells.

Table 17: Frequency of Time Target Child Spent in Exhibition by Facilitation and Gender

	Costumed		Blue Shirt		No Facilitation	
	Boys (*n=15*)	Girls (*n=16*)	Boys (*n=20*)	Girls (*n=16*)	Boys (*n=22*)	Girls (*n=10*)
Less than 10	27%	50%	53%	10%	73%	75%
More than 10, Less than 20	33%	31%	26%	60%	18%	25%
More than 20, Less than 30	27%	13%	11%	10%	5%	0%
More than 30, Less than 40	0%	6%	5%	10%	0%	0%
More than 40, Less than 50	7%	0%	5%	10%	5%	0%
More than 50	7%	0%	0%	0%	0%	0%

Table 18: Median Stay Times by Facilitation and Gender

		Circuit Bench		Circuit Table		Wind Table		Wind Bench		Goldberg Bench		Goldberg Table	
		Boys	***Girls***	***Boys***	***Girls***	***Boys***	***Girls***	***Boys***	***Girls***	***Boys***	***Girls***	***Boys***	***Girls***
Costumed		*n=2*	*n=1*	*n=3*	*n=8*	*n=6*	*n=6*	*n=2*	*n=3*	*n=8*	*n=6*	*n=9*	*n=9*
	Min	0:00:06	0:07:49	0:00:27	0:01:13	0:00:10	0:00:18	0:04:36	0:00:53	0:00:32	0:00:44	0:00:43	0:01:08
	Max	0:01:30	0:07:49	0:06:29	0:20:35	0:15:11	0:10:52	0:07:41	0:06:32	0:09:55	0:14:29	0:52:00	0:08:59
	Median	**0:00:48**	**0:07:49**	**0:01:17**	**0:04:14**	**0:04:44**	**0:01:05**	**0:06:08**	**0:02:13**	**0:01:38**	**0:02:00**	**0:13:16**	**0:05:30**
Blue Shirt		*n=9*	*n=3*	*n=6*	*n=5*	*n=7*	*n=5*	*n=2*	*n=3*	*n=6*	*n=5*	*n=6*	*n=9*
	Min	0:00:09	0:00:17	0:02:00	0:01:41	0:00:06	0:00:32	0:00:06	0:00:50	0:00:22	0:00:06	0:00:45	0:00:39
	Max	0:08:09	0:08:18	0:09:29	0:09:42	0:14:37	0:10:05	0:06:23	0:05:25	0:09:40	0:14:54	0:28:56	0:27:07
	Median	**0:02:01**	**0:00:29**	**0:06:49**	**0:05:44**	**0:01:00**	**0:02:11**	**0:03:15**	**0:04:40**	**0:03:19**	**0:00:32**	**0:06:27**	**0:04:54**
No Facilitation		*n=8*	*n=2*	*n=12*	*n=6*	*n=8*	*n=3*	*n=6*	*n=1*	*n=12*	*n=2*	*n=14*	*n=5*
	Min	0:00:15	0:00:03	0:00:03	0:00:55	0:00:05	0:00:13	0:00:35	0:01:41	0:00:23	0:02:43	0:00:28	0:01:26
	Max	0:14:39	0:04:22	0:23:59	0:05:20	0:06:00	0:00:22	0:05:17	0:01:41	0:04:37	0:04:23	0:09:09	0:03:15
	Median	**0:04:09**	**0:02:13**	**0:01:31**	**0:01:52**	**0:00:32**	**0:00:22**	**0:00:42**	**0:01:41**	**0:01:06**	**0:03:33**	**0:02:24**	**0:02:53**

Note the small n in some cells.

Table 19: Iteration, Success and Facilitation Counts: By Facilitation Condition and Gender

		Circuit Bench		Circuit Table		Wind Table		Wind Bench		Rube Goldberg Bench		Rube Goldberg Table	
Condition		**Boy**	**Girl**	**Boy**	**Girl**	**Boy**	**Girl**	**Boy**	**Girl**	**Boy**	**Girl**	**Boy**	**Girl**
All	Stopped	*n=19*	*n=6*	*n=21*	*n=19*	*n=21*	*n=14*	*n=10*	*n=7*	*n=26*	*n=13*	*n=29*	*n=23*
	Worked	*n= 7*	*n= 3*	*n= 12*	*n= 11*	*n= 8*	*n= 3*	*n= 6*	*n= 3*	*n= 11*	*n= 5*	*n= 14*	*n= 12*
	Iterate	4	3	7	8	3	2	3	3	4	5	10	9
	Success	3	2	6	5	5	3	3	3	1	3	4	5
	Facilitator	0	1	6	5	6	3	1	0	2	3	4	7
Costume	Stopped	*n=2*	*n=1*	*n=3*	*n=8*	*n=6*	*n=6*	*n=2*	*n=3*	*n=8*	*n=6*	*n=9*	*n=9*
	Worked	*n*= 0	*n*= 1	*n*= 2	*n*= 4	*n*= 2	*n*= 1	*n*= 2	*n*= 1	*n*= 3	*n*= 2	*n*= 6	*n*= 4
	Iterate	0	1	1	3	0	0	2	1	2	2	4	3
	Success	0	1	1	1	2	1	2	1	1	1	2	3
	Facilitator	0	1	2	2	2	1	0	0	1	2	2	2
Blue Shirt	Stopped	*n=9*	*n=3*	*n=6*	*n=5*	*n=7*	*n=5*	*n=2*	*n=3*	*n=6*	*n=5*	*n=6*	*n=9*
	Worked	*n= 5*	*n= 1*	*n= 4*	*n= 4*	*n= 4*	*n= 2*	*n= 2*	*n= 2*	*n= 4*	*n= 1*	*n= 3*	*n= 6*
	Iterate	2	1	3	3	1	1	1	2	1	1	3	5
	Success	1	0	3	3	2	1	1	2	0	0	1	2
	Facilitator	0	1	4	3	3	1	1	0	1	1	2	5
Minimal	Stopped	*n=8*	*n=2*	*n=12*	*n=6*	*n=8*	*n=3*	*n=6*	*n=1*	*n=12*	*n=2*	*n=14*	*n=5*
	Worked	*n= 2*	*n= 1*	*n= 6*	*n= 3*	*n= 2*	*n=0*	*n= 2*	*n= 0*	*n= 4*	*n= 2*	*n= 5*	*n= 2*
	Iterate	2	1	3	2	2	0	0	0	1	2	3	1
	Success	1	1	2	1	1	0	0	0	0	0	1	0
	Facilitator	0	0	0	0	1	0	0	0	0	0	0	0

Note the small n in some cells.

Table 20: Iteration, Success and Facilitation Percentage: By Facilitation Conditions and Gender

Condition		Circuit Bench		Circuit Table		Wind Table		Wind Bench		Goldberg Bench		Goldberg Table	
		Boy	Girl	Boy	Girl	Boy	Girl	Boy	Girl	Boy	Girl	Boy	Girl
All	**Stopped**	n=19	n=6	n=21	n=19	n=21	n=14	n=10	n=7	n=26	n=13	n=29	n=23
	Worked	n=7	n=3	n= 12	n=11	n=8	n=3	n=6	n=3	n=11	n=5	n=14	n=12
	Iterate	57%	100%	58%	73%	38%	67%	50%	100%	36%	100%	71%	75%
	Success	43%	67%	50%	45%	63%	100%	50%	100%	9%	60%	29%	42%
	Facilitator	0%	33%	50%	45%	75%	100%	17%	0%	18%	60%	29%	58%
Costumed	**Stopped**	n=2	n=1	n=3	n=8	n=6	n=6	n=2	n=3	n=8	n=6	n=9	n=9
	Worked	n= 0	n= 1	n= 2	n= 4	n= 2	n= 1	n= 2	n= 1	n= 3	n= 2	n= 6	n= 4
	Iterate	0%	100%	50%	75%	0%	0%	100%	100%	67%	100%	67%	75%
	Success	0%	100%	50%	25%	100%	100%	100%	100%	33%	50%	33%	75%
	Facilitator	0%	100%	100%	50%	100%	100%	0%	0%	33%	100%	33%	50%
Blue Shirt	**Stopped**	n=9	n=3	n=6	n=5	n=7	n=5	n=2	n=3	n=6	n=5	n=6	n=9
	Worked	n= 5	n= 1	n= 4	n= 4	n= 4	n= 2	n= 2	n= 2	n= 4	n= 1	n= 3	n= 6
	Iterate	40%	100%	75%	75%	25%	50%	50%	100%	25%	100%	100%	83%
	Success	20%	0%	75%	75%	50%	50%	50%	100%	0%	0%	33%	33%
	Facilitator	0%	100%	100%	75%	75%	50%	50%	0%	25%	100%	67%	83%
No Facilitation	**Stopped**	n=8	n=2	n=12	n=6	n=8	n=3	n=6	n=1	n=12	n=2	n=14	n=5
	Worked	n= 2	n= 1	n= 6	n= 3	n= 2	n= 0	n= 2	n= 0	n= 4	n= 2	n= 5	n= 2
	Iterate	100%	100%	50%	67%	100%	0%	0%	0%	25%	100%	60%	50%
	Success	50%	100%	33%	33%	50%	0%	0%	0%	0%	0%	20%	0%
	Facilitator	0%	0%	0%	0%	50%	0%	0	0	0%	0%	0%	0%

Note the small n in some cells. Since children could not iterate or have success if they did not work with the activity, the percentage of children who iterated or had success is taken from the total number that worked on the activity – not the number who stopped at it.

Table 21: Iteration, Success and Facilitation Counts: All Conditions and Gender

Condition		Circuit Bench	Circuit Table	Wind Table	Wind Bench	Goldberg Bench	Goldberg Table
All	**Stopped**	*n=25*	*n=40*	*n=35*	*n=17*	*n=39*	*n=52*
	Worked	*n= 10*	*n= 23*	*n= 11*	*n= 9*	*n= 16*	*n= 26*
	Iterate	7	15	5	6	9	19
	Success	5	11	8	6	4	9
	Facilitator	1	11	9	1	5	11
Costume	**Stopped**	*n=3*	*n=11*	*n=12*	*n=5*	*n=14*	*n=18*
	Worked	*n= 1*	*n= 6*	*n= 3*	*n= 3*	*n= 5*	*n= 10*
	Iterate	0	4	0	3	4	7
	Success	0	2	3	3	2	5
	Facilitator	0	4	3	0	3	4
Blue Shirt	**Stopped**	*n=12*	*n=11*	*n=12*	*n=5*	*n=11*	*n=15*
	Worked	*n= 6*	*n= 8*	*n= 6*	*n= 4*	*n= 5*	*n= 9*
	Iterate	3	6	2	3	2	8
	Success	1	6	3	3	0	3
	Facilitator	1	7	4	1	2	7
No Facilitation	**Stopped**	*n=10*	*n=18*	*n=11*	*n=7*	*n=14*	*n=19*
	Worked	*n= 3*	*n= 9*	*n= 2*	*n= 2*	*n= 6*	*n= 7*
	Iterate	3	5	3	0	3	4
	Success	2	3	2	0	0	1
	Facilitator	0	0	2	0	0	0

Note the small n in some cells. Since children could not iterate or have success if they did not work with the activity, the percentage of children who iterated or had success is taken from the total number that worked on the activity – not the number who stopped at it.

Table 22: Iteration, Success and Facilitation Percentages: All Conditions and Gender

Condition		Circuit Bench	Circuit Table	Wind Table	Wind Bench	Goldberg Bench	Goldberg Table
All	**Stopped**	*n=25*	*n=40*	*n=35*	*n=17*	*n=39*	*n=52*
	Worked	*n=10*	*n=23*	*n=11*	*n=9*	*n=16*	*n=26*
	Iterate	70%	65%	45%	67%	56%	73%
	Success	50%	48%	73%	67%	25%	35%
	Facilitator	10%	48%	82%	11%	31%	42%
Costume	**Stopped**	*n=3*	*n=11*	*n=12*	*n=5*	*n=14*	*n=18*
	Worked	*n= 1*	*n= 6*	*n= 3*	*n= 3*	*n= 5*	*n= 10*
	Iterate	0%	67%	0%	100%	80%	70%
	Success	0%	50%	100%	100%	40%	50%
	Facilitator	0%	67%	100%	0%	60%	40%
Blue Shirt	**Stopped**	*n=12*	*n=11*	*n=12*	*n=5*	*n=11*	*n=15*
	Worked	*n= 6*	*n= 8*	*n= 6*	*n= 4*	*n= 5*	*n= 9*
	Iterate	50%	75%	33%	75%	40%	89%
	Success	17%	75%	50%	75%	0%	33%
	Facilitator	17%	88%	67%	25%	40%	78%
No Facilitation	**Stopped**	*n=10*	*n=18*	*n=11*	*n=7*	*n=14*	*n=19*
	Worked	*n= 3*	*n= 9*	*n= 11*	*n= 2*	*n= 6*	*n= 7*
	Iterate	100%	56%	27%	0%	50%	57%
	Success	67%	33%	18%	0%	0%	14%
	Facilitator	0%	0%	18%	0%	0%	0%

Note the small n in some cells. Since children could not iterate or have success if they did not work with the activity, the percentage of children who iterated or had success is taken from the total number that worked on the activity – not the number who stopped at it.

Table 23: Percent of Children Who Worked, Iterated, or Succeeded at an Activity (n=91)

	Percent
Work	87%
Iterate	62%
Succeed	52%

Table 24: Percent of Children Who Worked at and Activity who Iterated or Succeeded, by Facilitation Condition

	All Conditions	Costumed	Blue Shirt	Non-Facilitated
Iterate	71%	68%	73%	72%
Succeed	59%	64%	65%	48%
n=	79	28	26	25

Table 25: Percent of Boys and Girls Who Worked at an Activity Who Iterated or Succeeded

	Boys	Girls
Iterate	70%	72%
Succeed	53%	69%
n=	47	32

Appendix D: Instruments

Family Interview

Adult

1. As a parent, what did you like, or not like, about the exhibits in this space?
Alt prompt: Do you think these exhibits are a good way for your kids to spend time at CP?
What makes you say that?

2. What do you think CP is trying to show with the exhibits in this space?
Alt Prompt: What's the big idea?

3. Is there anything in this exhibit that reminds you of something you've experienced or thought about before? Tell me more about that.
Alt Prompt: Did you feel a connection to anything in the exhibit?

Child

4. What is your name? How old are you? *I saw that you spent a lot of time at _____:*

5. What did you do at _____? Prompt: How did you do that?

6. What did you learn about [wind, electricity, simple machines, the fridge]? Tell me more about that.
Alt prompt: Did you figure something out when you were there? What did you figure out?2

[Questions 7, 8, and 9 asked of ages 8 and up, only]

7. Did you see anything or anybody that came from the past? What did you see? What did you notice about it?
Alt prompts: Does it remind you of something you have seen or used before?
How do you think people used that?

The people who made this exhibit wanted you to see that _____.

8. What does _____ tell you about people who lived in the past?
9. Why do you think they wanted kids like you to see it?

[Question 10 asked of all children]

10. Did you have fun in the exhibit? What was your favorite part? Do you think kids will like this exhibit? [positive wrap-up question - short]

Adult

11. While your child was at _____ what were you trying to do [with him/her]? What role were you playing?
Alt Prompts: How would you describe your role in the interaction?
What sorts of things were you thinking about?

Demos

12. Member? [Yes/No]
13. How often do you visit CP? [First time, once a year or less, multiple times a year]
14. Ages of people in group:_____

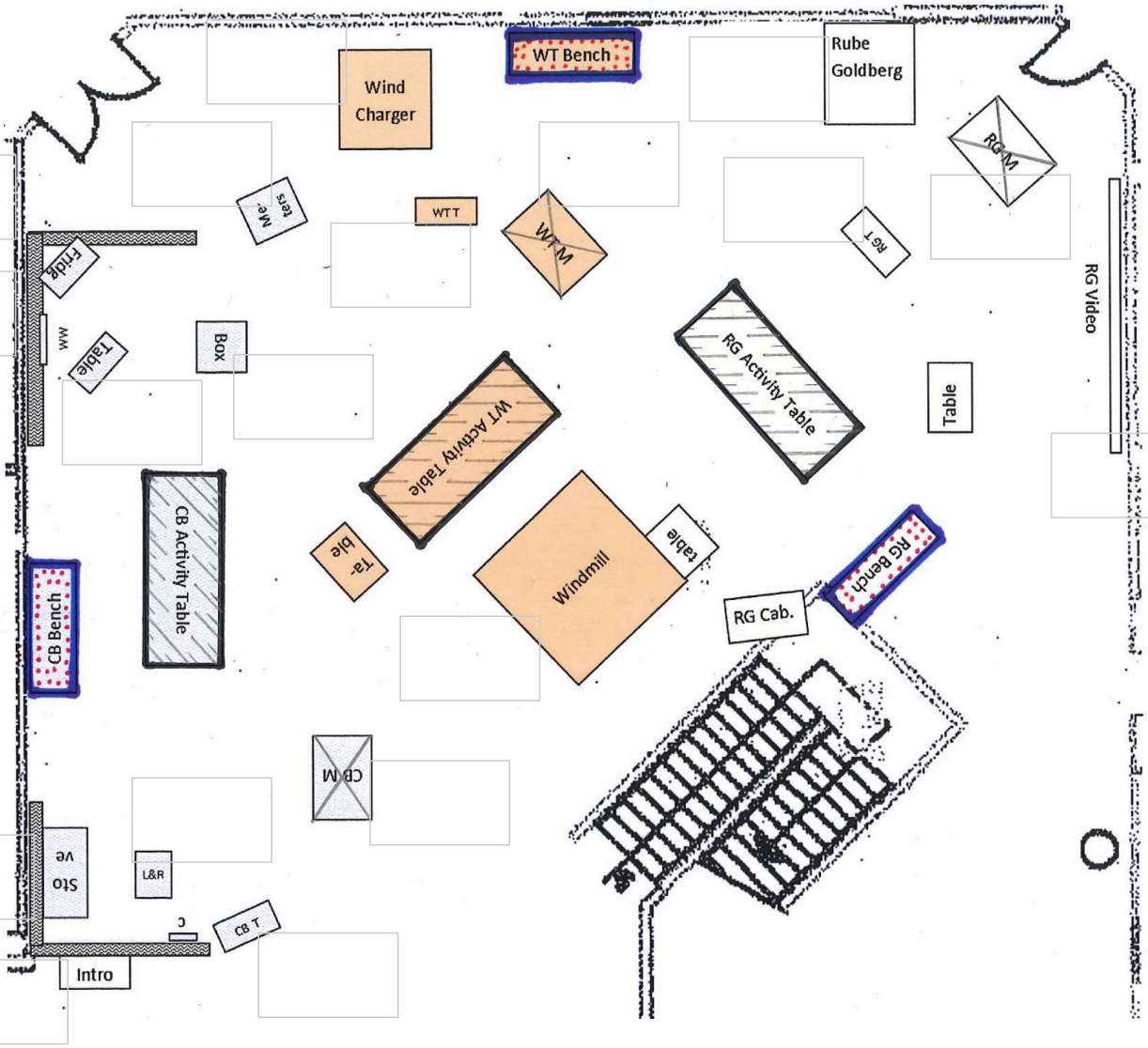
Timing and Tracking

The timing and tracking instrument is on the following page.

Date: **Time:**

Staff condition:
- ☐ Costume
- ☐ Blue Shirt
- ☐ Minimal Facilitation

Age: _____
- ☐ Male
- ☐ Female



Circuit **Bench**
- ☐ Worked with items
- ☐ Tried more than once
- ☐ Made thing that works
- ☐ Interacted with facilitator

Circuit **Activity**
- ☐ Worked with items
- ☐ Tried more than once
- ☐ Made thing that works
- ☐ Interacted with facilitator

_____
Instrument ID

Wind **Activity**
- ☐ Worked with items
- ☐ Tried more than once
- ☐ Made thing that works
- ☐ Interacted with facilitator

Wind **Bench**
- ☐ Worked with items
- ☐ Tried more than once
- ☐ Made thing that works
- ☐ Interacted with facilitator

Rube **Bench**
- ☐ Worked with items
- ☐ Tried more than once
- ☐ Made thing that works
- ☐ Interacted with facilitator

Rube **Activity**
- ☐ Worked with items
- ☐ Tried more than once
- ☐ Made thing that works
- ☐ Interacted with facilitator

End of Report