

Formative, Remedial and Summative Evaluations of
My Sky
Boston Children's Museum
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Executive Summary

My Sky is a NASA funded project, which developed a national traveling exhibition on astronomy. Boston Children's Museum (BCM) created the exhibition in collaboration with the Smithsonian Astrophysical Observatory (SAO). The exhibition will travel to children's museums across the country. Formative and remedial evaluations were conducted at BCM while the summative evaluation took place at the first two venues following BCM: Stepping Stones Museum for Children (Stepping Stones) in Norwalk, CT and The Providence Children's Museum (PCM) in Providence, RI. Formative evaluation of the *My Sky* exhibit was conducted between April 2013 and June 2014 to ensure that the components under development were useable and understandable for the target audiences. Remedial evaluation was conducted during the six months that the exhibit was at BCM. A remedial evaluation report was submitted on December 5, 2014 based on data collected between July and November 2014. The summative evaluation was conducted to provide information for the exhibit development team to determine the extent to which the project goals were met and if the exhibit was successful in accomplishing its intended outcomes. Quantitative and qualitative methods were used to collect data between March 2015 and August 2015.

The exhibit was very well received by members of the target audiences. Both adult caregivers and children aged 5-10 spent significant time in the exhibit at each of the three locations. Spending time with the components led to gains in science knowledge as observed by the evaluator during the formative and remedial evaluations and from the surveys and interviews conducted during the summative evaluation. Adult visitors indicated during the summative evaluation that they learned some science and that their children learned a great deal of science in the exhibit. Children, with their adult caregivers were observed practicing foundational science skills at several components of the exhibit. Adults surveyed after their exhibit visit were cognizant of the connections their children were making to science content and process skills. Connections to NASA were more problematic. Two components had direct connections to NASA (the Helioviewer and the Big Moon) and several labels throughout the exhibit presented stories of scientists, artists, or other people who are inspired by the sky. Unfortunately, most adults did not read this information. Therefore few adults could associate their exhibit experience with the work being conducted by NASA scientists.

Overall, the exhibit was extremely successful in meeting its goals. Visitors were interested in the topic, learned science and practiced foundational science skills. Parents and children worked together and did not shy away from components that included science content.

Introduction

The evaluations for this project were aligned to the goals set out by the exhibit team. Several goals for the *My Sky* project were defined in the proposal submitted to NASA including:

1. Inspire in children ages 5-10 and their adult caregivers an appreciation for the celestial objects visible to them as a foundation for later understanding of astronomy and astronomical discovery;
2. Provide resources and model strategies for adult caregivers to effectively encourage and guide astronomy science-learning experiences for their children;
3. Support the development of STEM skills in children;
4. Encourage practical application of those skills for children and adults as they explore celestial objects together;
5. Expand the capacity of museum staff to engage families in learning STEM skills through astronomy exploration; and
6. Impress upon visitors that the sky is a science learning resource that we all have available to us.

More specific goals developed by the exhibit team for the exhibit itself include:

1. Engage children in developmentally appropriate science content and inquiry, helping them acquire knowledge and skills that lead to appreciation for and understanding of astronomy;
2. Encourage parents to actively collaborate in their child's science inquiry as co-learners;
3. Help parents make connections between the sky they observe with their children— *My Sky* —and the sky observed with NASA instruments —“NASA's Sky;”
4. Help adults recognize connections between this exhibit experience and science learning opportunities in their everyday lives.

Description of the *My Sky* Exhibit (descriptions and images courtesy of the *My Sky* exhibit website)

My Sky is a 1500 square foot traveling exhibit comprised of five distinct areas, The Skatepark, The Heliviewer (aka SunScreen), The Big Moon, The Bedroom and The Backyard. During each of the evaluations, components within each of these areas were evaluated for visitor interest, gains in content knowledge, parent child interactions, children practicing foundational science skills, parents making connections to NASA and making connections between the exhibit and everyday lives.

The **Skatepark**, consists of a dome where the light of the “Sun” traces a path of a day in a matter of seconds. Here visitors can observe how shadows change over time using a lever to speed up and slow down the movements of the “Sun.” Standing on a skateboard, visitors can create a human sundial as they watch their own shadow arcing across the floor as the day progresses.



The **Helioviewer (also known as the SunScreen)** displays images of the sun created by NASA’s Solar Dynamic Observatory. Visitors can use a dial to move through each day of a year and watch videos of phenomena such as flares and solar tornadoes.



The Big Moon is a 5-foot diameter, topographically accurate scale model of the moon that resides in a large dome. The moon was created using data from NASA’s Lunar Reconnaissance Orbiter. Visitors can rotate and explore this model of the moon, touching its mountains, valleys and craters.



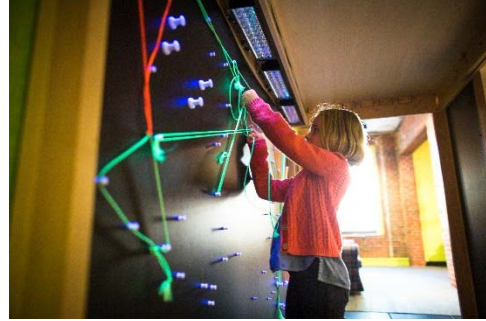
The Bedroom/Child’s Room

The Bedroom features three components. The Orrery allows visitors to manipulate a mechanical Earth-Moon model to explore the phases of the moon. At the Constellation Creation, visitors can find known constellations and create their own using glow in the dark strings. Finally, the bunk bed allows young visitors to climb into the loft.

The Orrery



Constellation Creation



The loft of the bunk bed



The Backyard

The major component of the backyard is a large screen presenting a 24-hour time lapse of the sky. Additional activities include tents that children can climb into and a fireplace for pretend camping. A large tree contains nocturnal animals from BCM's collection. Two telescopes allow visitors to view stars and planets in their real-time positions in the sky. When the telescopes are moved, the view changes.



Programming to accompany the exhibit

In addition to material developed by BCM, each of the sites developed their own stand-alone and interpreter-led activities. At Stepping Stones these included hands-on activities (such as constellation lacing cards), which were available on a small table in the hallway adjacent to the exhibit. Also, interpreters at carts provided activities about light (prisms, refraction) in hallway adjacent to exhibit. Stepping Stones also provided a half hour group program called *Looking Up* on Wednesday afternoons.

At PCM, the activity table always had material (eg. constellation lacing cards) available for visitors. Interns had shifts in the exhibit to facilitate additional activities (eg. straw rockets). A handout was available with more activities to do at home.

Findings

Formative Evaluation

Formative evaluation of the *My Sky* exhibit was conducted between April 2013 and June 2014 to test the success of several exhibit components. This type of evaluation was used to ensure that each component under development was useable and understandable for the target audiences. During early rounds of testing, BCM staff and evaluators from SAO facilitated activities with visitors. Comments and reactions to the activities were collected and used in the development of stand-alone components. Many of the actual words used by visitors during early stages of prototyping were incorporated into text labels for the next round of testing. The primary evaluation method utilized during the second round of testing was interactive observation. Visitors' behaviors and conversations were observed and recorded at stand alone components and the evaluator intervened as necessary to gather more in-depth information from visitors regarding their learning at the component. An informal interview followed each visitor interaction.

The first component tested was called Constellation Creation. The goal of this interactive is to encourage families to work together to find known constellations and invent their own constellations using a large star field. This component went through several iterations during the prototyping process: from asking visitors to trace constellations on transparencies; to having them using light to draw patterns on a phosphorescent star field, with the light trails connecting the stars; and finally allowing visitors to create constellations using pegs and glow in the dark elastic strings. The venue for the activity changed over time as well. It began as an open space, then became enclosed with openings at either end of the star field to ensure a dark environment to its final iteration - a small space under a child's bedroom loft which is open in the front and on the sides. The placement and size of labels and the configuration of the space were integral in the final design of the component. When the labels were small or behind the visitors' workspace, children were not sure what to do at the component without receiving instructions from staff members. When the space was closed, parents did not feel welcome to join their children and instead stood outside of the activity space. Once these factors were addressed, multiple groups began to work together in the space and parents often interacted with their children at the activity. While few visitors could find the known constellations, many created their own shapes and designs using the elastic strings including a cowgirl, a rope, a stingray, a rock, a spoon, a kite and a star. A five year old created a horse and an alligator. One girl tried to make the sun but had a difficult time making round objects.

The second component tested was the Orrery. The goal of this activity is to reinforce the relational nature of the phases of the moon and help visitors overcome the misconception that the phases of the moon are caused by the Earth's shadow. Visitors interact with an orrery of the Earth, Moon and Sun on a desk next to a window. Outside, through the "window," visitors see a corresponding image of the moon. As the orrery is manipulated, and the Moon and Earth positions on the orrery change, the Moon phase through the window changes in a manner that corresponds to the manipulation of the orrery. This

component was also prototyped over several months with several changes to both mechanical and digital elements. Once these were working properly, several parents and children were observed working together and conversing. Label placement was tested to ensure that parents read both the instructions and the background information. Overall the adults were most intrigued with this component. There were definitely some “ah ha” moments when they watched the position of the moon as it moved around the Earth during different phases (especially the full moon). This interactive proved to have great potential in addressing misconceptions about what causes the phases of the moon with both older children and adults.

Visitor comments which indicated the learning potential of this component include:

"I made a crescent moon -- yay!"

"I'm going to make a solar eclipse."

"... A solar eclipse! [when moon was at new moon position]... Bigger, bigger, bigger...[as animation went from crescent to full]"

"Keep going 'til you make a solar eclipse."

During prototyping, staff and evaluators were also able to practice different lines of questioning which had the potential to serve as label challenges with target-aged children. With a little prompting, most visitors were able to use the model to answer the questions. The younger children enjoyed turning the crank but also tried to move the model using their hands (mostly on the moon ball). Some of these younger children were not sure which ball represented the moon and a few were not even sure that the light was the sun. For the older children this was less of an issue. One rising 4th grader had done this activity in school and knew all of the phases of the moon and the location of the moon for each phase.

The Time Lapse video was prototyped on a few occasions. The goal of this component is to allow visitors to explore the same area of the night sky over a twenty-four hour period. The Time Lapse video was created specifically for the *My Sky* exhibit and the location and direction of the video allow visitors who may not be able to get away from city lights to experience the night sky. Evaluators and museum staff used challenge cards to determine if children could find patterns in the night sky and find specific celestial objects (the moon, constellations, planets, clouds) and manmade objects such as airplanes. It was determined that both children and adults enjoyed looking for objects in the video and worked together to find these items.

The Big Moon was not available to test prior to the exhibit opening but the Museum staff did set up a cardboard dome for visitors to explore. From this early prototype, they were able to learn that parents often had to be coaxed inside the dome. Parents would allow their children to enter but just peek in themselves. Younger children (ages 3-5) were most interested in running around and touching things. They liked the dome and were drawn into the space but barely noticed the stars overhead. Older children (6+) were very engaged looking at the stars. Children and adults talked about what they could see and some even took the time to lie down on the floor to watch the stars imagining patterns.

“I see a dog.”

“I see a whale.”

“This is beautiful.”

The Helioviewer allows visitors to observe the sun using images from NASA’s Solar Dynamics Observatory. Early stages of this activity engaged visitors in viewing four different movies without controlling the speed or changing the date. Initial reactions to the activity were very positive from older children and adults. They wanted to control more of the activity but these early videos gave the team an indication of what components of the sun (flares, solar tornadoes, transits, etc.) were of interest to visitors and should be incorporated into the final component.

The Telescope allows visitors young and old to view celestial objects through this piece of scientific equipment. This component was extremely popular with children and adults of all ages. Visitors who were observed described what they saw through the telescope. Some mentioned stars, constellations, words, and even a map. One six-year-old girl thought she saw Neptune and the Milky Way. Another six-year-old girl thought she saw a dragon. A four-year-old boy saw constellations and a tornado! Four (out of ten) adult caregivers observed read the label to their children. Others asked the question that was on the label to their children. When asked a question, all children responded, which started conversations between adults and children. Often an adult was surprised when a child said that they saw stars instead of buildings (as the telescope was pointed out a window in the museum facing buildings across the channel). Once parents understood that their children were not looking out the window, the majority of them inquired about the Star Walk program, which was creating the images of the stars and planets through the telescope’s lens. Cooperative behavior, including turn taking was also observed.

The final activity tested centered on the process of sonification of astronomical data, with a blind astrophysicist highlighted as a real scientist using this technique of data analysis. The activity as developed was difficult for children in the target age to comprehend and adults often watched but did not participate in the activity. For example, one adult read the label to herself but did not try to engage her son beyond playing with the instruments.

Overall, many of the prototyped components elicited significant parent-child interaction. Children were also observed practicing foundational science skills such as observing, asking questions, communicating and using their imaginations. Many iterative changes to components such as the Orrery and the Constellation Creation led to measurable improvements in time spent at the components and appropriate behaviors at the activities.

Remedial Evaluation

My Sky opened to the public on July 26, 2014. Remedial evaluation began in August 2014 and continued through December 2014. Initially, the evaluator spent an hour observing visitors at each completed component. Components which could not be tested during formative evaluation, including the Big Moon and the shadows activity in the Skate Park were evaluated in addition to those evaluated during prototyping. When possible, visitors were also interviewed. Initial findings and recommendations were presented to the BCM exhibit team and a list of remedial changes and priorities was created. Over the next several weeks, as these changes were incrementally implemented, the evaluator returned to observe and interview visitors. Simple changes were made on the spot during evaluation sessions (label additions and copy changes). Larger modifications were completed by the shop as time permitted.

Overall, two major themes emerged over the course of the evaluation: interactions between children and adults and the use of play to encourage science learning.

Throughout the exhibit, interactions between adults and children were observed. The three areas/components with the most adult-child interaction were the bedroom, (including the Orrery, Constellation Creation and the bunk bed), the Telescope and the Heliviewer. At these components, adults were observed participating in and conversing about the activities with their children.

The Orrery is a prime example of an exhibit in which parents seemed to be comfortable sitting down and interacting with their children. This may be due to that fact that this is seen as an activity designed for both audiences. The groups that included an adult spent well over a minute at this component. Both adults and children turned the crank and looked at the orrery. Many also looked at the window and a few read the instruction label. For these groups, parents/caregivers were involved in their children's learning. Many took the opportunity to explain what was going on in this exhibit - the phases of the moon. A few used the instruction label but others relied on their own knowledge to share with their children.

In Constellation Creation, most of the children who used the strings appropriately and created their own patterns, were guided to do so by adults. Parents were also observed helping their children create patterns. A few parents did read the instruction label to their children, although only those who were very close to the sign. A few groups took the initiative to try to recreate the Big Dipper and Orion although this was a difficult task and they were often using the incorrect stars.

At the bunk bed, parents and caretakers were observed helping younger visitors to get in and out of the bed and to use or learn how to use the ladder. They also helped their children learn to take turns with other children. There were a few skirmishes over using the bed but adults seemed to be doing a great job helping the children negotiate and take turns.

Adults and children also interacted at the Telescope exhibit. Small children struggled to get hold of the eyepiece end of the telescope but they were always helped out by a friend or adult. Children not familiar with telescopes often looked in the other end of the telescope but when they did not see anything (or were told to do so by an adult), they looked through the correct end. Parents/caretakers usually did not look through the eyepiece unless prompted by their children. Once they did, they were surprised and amazed.

The Heliviewer was most often used together by adults and children. While the label on the kiosk was not often read in its entirety, adults and children watched the videos together, which often sparked conversations about what they were viewing.

There were fewer adult/child interactions in the Skate Park and in the Backyard. Parents watched their children in these areas but were less likely to actually participate.

In the Skate Park, most children flocked to the bicycle. The majority of children and adult caregivers did not notice the shadows made by the bike as the light passed overhead. Several adult caretakers associated pedaling with changing the speed of the lights. While it is wonderful that adults noticed the lights, they did not associate the lights with shadows (unless prompted). Parents took pictures of their kids but few actually stood on the skateboard or used the lever. Once labels were added to the floor and lever, these behaviors changed.

In the Backyard, young children really enjoyed the tents (even the one without the music), the sleeping bags and especially the fire. Adult caregivers really seemed to enjoy taking a break in the adirondack chairs but most watched on as their children played in the space and few were seen actually role playing with their children. A large number of adults were observed sitting in the chairs while their children/grandchildren/charges roamed around the exhibit beyond the campsite. This is a great spot to keep an eye on kids in the rest of *My Sky*. Unfortunately, they were blocking the majority of label copy for the Time Lapse activity from other visitors while they rested here.

The second theme – using play to encourage science learning was evident in some of the exhibit components.

For example, in the Bedroom, climbing up into the bunk bed was very popular and led to great behaviors (sharing, taking turns, learning how to climb up and down). The activities associated with the bed and ladder did not detract from visitors using the Orrery or the Constellation Creation. In fact, some visitors (especially camp groups) were seen using the Constellation Creation activity as a staging area for groups waiting to use the ladder. Others participated in this activity after playing on the bed while waiting for others in their group to finish climbing into the bed.

In other areas, elements of the exhibit which encouraged role-playing became more interesting than the salient features of these components and became a distraction to learning science.

First, as mentioned above, the presence of the bike in the Skate Park, while extremely fun for children, actually led to misconceptions about how lights were being controlled and took away from the focus on shadows. Several comments were overheard from adult caregivers such as “See you turned the lights on” or “Pedal faster, you can make the lights go faster.”

The tents and the fire provided great role-playing opportunities but distracted from the content in the Time Lapse video. Labels were first added flat on the arms of the Adirondack chairs, presumed to be a highly visible location for visitors to access the information within. Adults were often observed resting their arms on the chairs, obscuring the labels, and diminishing their usefulness. Until labels on chairs were changed (wedges added) and additional labels were added to the base of the Time Lapse, very few adults were observed viewing the video and even fewer discussed the activities associated with the video with their children. The majority of discussions were of stories about camping trips – toasting marshmallows and sleeping in tents – but no mention of seeing the stars during these trips.

A few of the components had a few glitches, but these were addressed during the remediation of the exhibit.

The Heliviewer component had two categories of movies from NASA’s SDO satellite. One set of movies was composed of short “highlights” of solar activity, showing particularly prominent solar flares, coronal mass ejections and transits of Venus and the Moon. One other movie was a longer, year-in-the-life movie of the Sun in 2014. If a visitor was watching the longer movie, scrolling through the year using the Spin Browser interactive, another visitor (often younger) would often run up to the cabinet and press one of the shorter movie buttons, which overrode the Spin Browser and interrupted the first visitor’s observations. That first visitor then could not return to their viewing of the sun-over-a-year video until the end of the shorter movie. While constant button pushing is great fun, it prohibited those who were trying to learn more about the sun.

The Big Moon in its original state with a large gimbal was unsafe, and fast spinning in all directions, which was at odds with learning about the moon. This has since been corrected, along with the addition of an audio tour, and visitors of all ages are now able to learn a great deal about the moon.

Small but successful changes were made to several of the components to address challenges.

Wedges were added to labels on flat surfaces (on the adirondack chairs and at the Orrery station.) Before adding the wedges, the labels were blocked by arms or objects being placed on them and were difficult to read. In the Backyard, many more adults looked at/read the instruction labels when they tried to place their arms on the arm rests and noticed that they couldn’t. This sometimes led to them looking at the time lapse and asking questions with their children.

Label copy was added to several of the components.

Large introduction labels were added to a few components to draw attention and to allow adult caretakers to immediately know what the exhibit was about. Two header labels were added over the screen on the Helioviewer, which read: “Watch the Sun” and “What Do You Notice”. These two simple signs greatly enhanced visitors’ holding time and comprehension of the goals and messages of this component. Before the additional labels were added, a number of visitors did not know that they were observing the sun. After the addition of these labels there was no question that the images on the screen were the Sun in action. All comments were related to what was happening on the sun. Adding the “Watch the Sun” label prompted many adults to watch more of the movies and talk about them with their children.

New instruction labels were added to the Time Lapse case – “Can You Find Orion? Can you find Jupiter? What is Your Favorite Constellation?” Many adult visitors did read these aloud to younger visitors. A number of groups did look for Orion but it comes up early in the night and moves very quickly across the sky – easy to miss. Others did not know what Orion looks like.

Floor labels were added to the shadow activity in the Skate Park. The labels on the floor were read aloud by both children and adults. Visitors young and old now commented that the activity was about shadows. The addition of these words prompted visitors to spend a few more seconds on the skateboard looking at their shadows over time. For example, one adult female caregiver read “Watch Your Shadow, What Do You Notice?” and commented: “Oh, it’s about your shadow on the ground. It changes during the day.” This was without reading the instruction label.

Changing the orientation of the Backyard area and taking away the fire pit allowed parents and caregivers to focus their attention on the Time Lapse activity. Parents can no longer sit and watch children in the entire exhibit, but rather have their attention directed toward the Time Lapse. There was still a lot of role-play observed in the area but now visitors also focus on the science activity as well.

Larger modifications also led to successful interactions with the activities.

The Big Moon now spins on one axis. Children still spin the moon very quickly but they can also move around the space more easily. The calm music on the audio tour seems to slow them down – at least a bit.

The Helioviewer program was changed so now all movies work in conjunction with the spin browser. As soon as the accompanying kiosk label is changed, this should be working optimally.

Recommendations were made for modifications for components in each of the major exhibit areas based on remedial evaluation findings.

Skateboard Park

Evaluation Findings:

- The bike anywhere in the skate park led to confusion that pedaling the bike somehow makes the lights work. Also very few visitors (young or old) looked at shadows while on the bike unless prompted.
- Prototype signs on floor worked great. The majority of visitors read the signs and starting using the word shadow in conversations. The addition of the signs also increased parent/child interactions.
- Tic marks on the floor, suggesting hours on a clock that shadows made by the skateboard point to throughout the “day”, were also tested. There is no conclusive evidence that the tics either helped or hindered the experience for visitors. The addition of noon or 12:00 is more critical for allowing visitors to try the shadow challenge question. The tics might be useful to educators interpreting in the space.
- Visitors used the lever and read the instruction label when a label is present at the lever. Two versions were tested; one with a question about the sun’s position and the time of day for visitors to try and one that simply stated “faster/slower”. Either version is ok to use but if the faster/slower is chosen, more information about shadows needs to be presented elsewhere (background label on back wall, or as part of a question on the floor).

Recommendations (these recommendations were addressed in the final version of the exhibit):

- Final signage installed on floor, next to lever and on back wall.
- Bike should be removed from the park. It does not need to be removed for the entire exhibit, just should not be in the skate park proper.

Helioviewer

Evaluation Findings:

- Most of the findings were presented above. The addition of introductory labels on the case of the Helioviewer successfully allowed visitors to immediately know what this activity was about.
- With the change in programming, there should be much less interruption of movies.
- The attract screen did not serve to introduce visitors to the activity and did not link this activity to the skate park. It has since been removed.
- The label on the kiosk was not read in its entirety. There was a lot of information presented and it no longer matches the new movies.

Recommendations (these recommendations were addressed in the final version of the exhibit):

- New kiosk label
- Final introductory labels on case

Big Moon

Evaluation Findings:

- Once the structure surrounding the moon was changed, an audio tour was tested with and without music. The music version seems to slow down young visitors but this was tested with school groups so there is not much family data to back this up.
- Few visitors stayed for entire tour but family groups did listen to it and some parents did have their children look for feature on the moon presented in the tour.
- Now that the interpreters are no longer in the dome all the time, some visitors do not know that they can touch the moon or that the large object is even the moon.

Recommendations:

- Label copy on the outside of dome to let visitors know:
 - This is the moon
 - You can touch it

Backyard

Evaluation Findings:

- As mentioned above, this area is great for role-play.
- There are still a few problems with the iPad in the tent. Sometimes it gets turned off and other times visitors are able to “get out” of kiosk mode.
- The Time Lapse is not being used to its full potential. The addition of wedges on the chairs and the labels on the base helped a great deal. The labels on the chairs need to be changed so that the orientation of Orion matches that in the sky. These labels only work for those sitting in the chairs.
- The new faster day/slower night, *Time Lapse* video should greatly improve visitors’ ability to spot objects in the sky. The annotated version should do an even better job at this. These have not yet been evaluated, but do currently exist in the exhibit.
- The background labels are still missing in this area of the exhibit.
- The tree is of interest to visitors but there are no labels so visitors can’t identify any of the animals.

Recommendations:

- ID labels for the tree. (This recommendation was addressed in the final exhibit)
- Background labels for the area.
- Labels on chairs changed so that the Orion on the diagram matches the orientation in the video.

Bedroom:

Constellation Creation/Bed

Evaluation Findings:

- The lights make all the difference. The component is much more popular when all of lights are on.

-The instruction label is very small and dark and is read by only those who are right next to it.

-Visitors also currently have a difficult time finding constellations on the small instruction label. A new background is being created which should make it much easier for visitors to use.

-Additional background and scientist labels are not read at all. They are too dark and small.

-The bed is used by visitors of all ages (even adults during adult-only functions).

-The couch is used mainly by adults who are either using their technology or watching their children. The bookcase contains many good books on astronomy but only one parent was observed reading to a child. The shelf on the bookcase is loose and fell off a few times during observations.

Recommendations (these recommendations were addressed in the final version of the exhibit):

-New bigger/brighter label for the activity.

-New background with easy to find constellations.

Orrery

Evaluation Findings:

-There is still a problem with the light. The first light installed shined directly in the eyes of visitors entering the exhibit. A new light was installed but this does not allow for a crisp terminator on the moon.

-Very few visitors actually read instruction label and even fewer read additional labels.

Recommendations:

-A permanent solution for the light (this recommendation was addressed in the final version of the exhibit)

-Rethink background labels.

Telescope:

Evaluation Findings:

-As mentioned above the telescope worked great for visitors of all ages. The eyepiece is high for children to reach but they used this opportunity to have older children or family members reach it for them. No visitors were observed that were unable to use the activity because of the height. A lot of the children looked in both ends of the scope or looked in the wrong end first because it was lower and did not see anything. A number of kids also pulled it down and let it go, but this telescope seems sturdy enough to take this abuse.

Many adult caretakers were surprised to hear comment about stars from their charges as they suspected that the children were looking around the room with the telescopes.

- The one thing that seems to be lost on visitors is that this telescope is pointing to objects in the sky in the direction that the telescope is pointing. Many of the kids who used the scope noticed that the sky changed as they moved the telescope but they did not go further than this.

Recommendations:

-Labels that were present during prototyping were taken away during the remedial evaluation. These labels let visitors know how they could get this program at home. These labels should be added back to the component.

Bianca's movie:**Evaluation Findings:**

-This activity was tested with a speaker and with headphones. The speaker sometimes did not work and the movie often popped out of its loop. It worked better with one headphone than with two but that took away from families using this together. Not many visitors watched/listened to the movie but those who did (both young and old) seemed to stay for the entire piece. The vocabulary was difficult for some of the younger viewers. When interviewed, they were not sure what they had watched but they liked it.

Recommendations:

-A stand-alone version that can stay on the floor.

Graphics overall**Evaluation Findings:**

- All of the labels seem to be too small and too dark for visitors to read.
- Very few background labels were read by visitors.
- None of the scientists/artists labels were read.

Recommendations:

-Reprint labels especially Scientist/Artists larger and brighter.

Many of these recommendations were put into place before the exhibit traveled to its first venue - Stepping Stones. Bianca's movie and the Sonification activity did not ultimately make it into the final traveling exhibit.

Summative Evaluation

The *My Sky* summative evaluation was conducted to provide information for the exhibit development team to determine the extent to which the project goals were met and if the exhibit was successful in accomplishing its intended outcomes.

Specific questions were proposed for the summative evaluation by the exhibit team, which include:

1. Are visitors practicing the foundational science skills identified for each component?
2. Are parents able to use information presented at each component to engage their children in these skills and with NASA content?
3. Can parents make connections between the *My Sky* activities with NASA research?
4. Do programmatic activities provide opportunities to further investigate the sky?

Quantitative and qualitative methods were used to collect data between March 2015 and August 2015. Data were collected from the Stepping Stones Museum for Children between March and May 2015. Exit surveys were conducted by Stepping Stones staff while exit interviews were conducted by members of the evaluation team from the Smithsonian Astrophysical Observatory. Data were collected at the Providence Children's Museum during July and August of 2015. PCM staff members conducted exit surveys and SAO staff members conducted all exit interviews.

The BCM exhibit team worked closely with the two museums to provide an optimal experience for visitors. This was challenging because of space constraints in both museums. A new floor plan was designed for each institution. In the case of Stepping Stones, the couch and books from the exhibit had to be placed in an adjacent hallway. The telescopes were not used at this venue. At PCM, a much smaller space was provided for the exhibit. Therefore the Skatepark area and the tree in the Backyard were not present. The Time Lapse video was located on the wall opposite to the rest of the backyard components. Only one tent and one telescope were present here. Also because the doors to the museum were not wide enough to accommodate the Big Moon, this component was not available to evaluate. The large dome that houses the Big Moon was placed in the exhibit. PCM staff developed a new audio tour to accompany a flat moon on the floor of the dome. PCM was chosen as a test site with these limitations in mind in order to evaluate the potential efficacy of *My Sky* if it travels to smaller museums with similar constraints in the future.

Instruments Used During Summative Evaluation

Two instruments were utilized during the summative evaluation. An exit survey for adults accompanying children to the exhibit and a protocol for implementing the survey were developed at SAO and then reviewed with BCM staff. The instrument and protocol were both reviewed by the Director of Exhibit Design and Delivery and the Director of Learning and Experience at Stepping Stones. During the spring of 2015, the survey was

distributed to visitors by museum staff and completed by 59 adults accompanying children to the exhibit.

The survey was modified for Providence Children's Museum since some of the components were not available to evaluate. The new form was reviewed and approved by the Director of Exhibits at PCM. During the summer of 2015, museum staff distributed the survey, which was completed by 44 adults accompanying children to the exhibit.

A set of interview questions for adults or children and an accompanying protocol for interviewing adults and children were developed at SAO and then reviewed with BCM staff. The interview questions were sent to Stepping Stones for review by both the Director of Exhibit Design and Delivery and the Director of Learning and Experience. During April 2015, 30 interviews were conducted with groups of adults and children by SAO staff members.

The interview questions were modified for Providence Children's Museum and reviewed by BCM staff and the Director of Exhibits at PCM. During July and August 2015, 33 interviews with groups of adults and children were conducted by an SAO staff member.

A timing and tracking instrument and accompanying protocol was also developed with the understanding that museum staff would collect these data. Unfortunately, staff at both museums did not have the capacity to complete this task, so tracking and timing data were not used as part of this evaluation.

Results

Demographics

At both institutions, like at BCM, most children, 76% at Stepping Stones and 84% at PCM were accompanied by parents. Other adults visiting with children included grandparents, other family members, friends and caregivers. At Stepping Stones, 78% of adults accompanying children were female and 22% were male. At PCM, 61% of adults accompanying children were female and 39% of adults were male.

The age of children accompanying adults surveyed in the exhibit ranged from 1-13. For the interviews, evaluators tried to choose children to be interviewed who were in the exhibit's target age range of 5-10. The average age of children interviewed was between 5-12. Permission was granted from an adult caregiver for each child before they were interviewed.

Visitors' overall impressions of the *My Sky* exhibit

Visitors were asked two questions to determine their overall impression of the exhibit: what is one thing that you will remember most about your visit to *My Sky* and if you were to describe this exhibit to a friend, what would you say about it?

The most memorable features of the exhibit reported in both surveys and interviews include the Big Moon (at Stepping Stones), the Heliviewer, the Telescope (at PCM) and components in the Bedroom (the Orrery, Constellation Creation and the bed itself) at both locations.

At Stepping Stones, an average of 37% of visitors mentioned the Big Moon as memorable and an average of 23% mentioned at least one of the components of the Bedroom. At PCM, the Heliviewer was mentioned by an average of 22.5% of visitors, while the Big Dome (even without the moon) and the Bedroom components were mentioned by 19% of visitors. The Telescope was a big hit, being mentioned as most memorable by 15% of visitors at PCM.

Comments which highlight the impression made on visitors by these components include the following:

Comments about the Big Moon from Stepping Stones visitors include:

“I liked the moon. It was cool to see the parts of it, the dark parts that we can't see.”

“The moon - it looks like it has real stars, someone is talking and helping you learn.”

“I liked the moon. You could spin it around and one part looks like the man in the moon.”

“The moon because it's like you are in space and nobody gets to be in space.”

Comments about the Bedroom from Stepping Stones and PCM include:

“My kids really liked cranking the moon, the window (Orrery) was cool.”

“The part when we did glowing strings (Constellation Creation). I made the Big Dipper.”

“The bedroom – you can make stars like shapes of stars.”

“I liked the bedroom - the glow in the dark strings.”

“The place where you make stars.”

Comments about the Heliviewer from Stepping Stones and PCM include:

“Where you can see the sun in all of the movies.”

“The big sun.”

“The exploding sun”

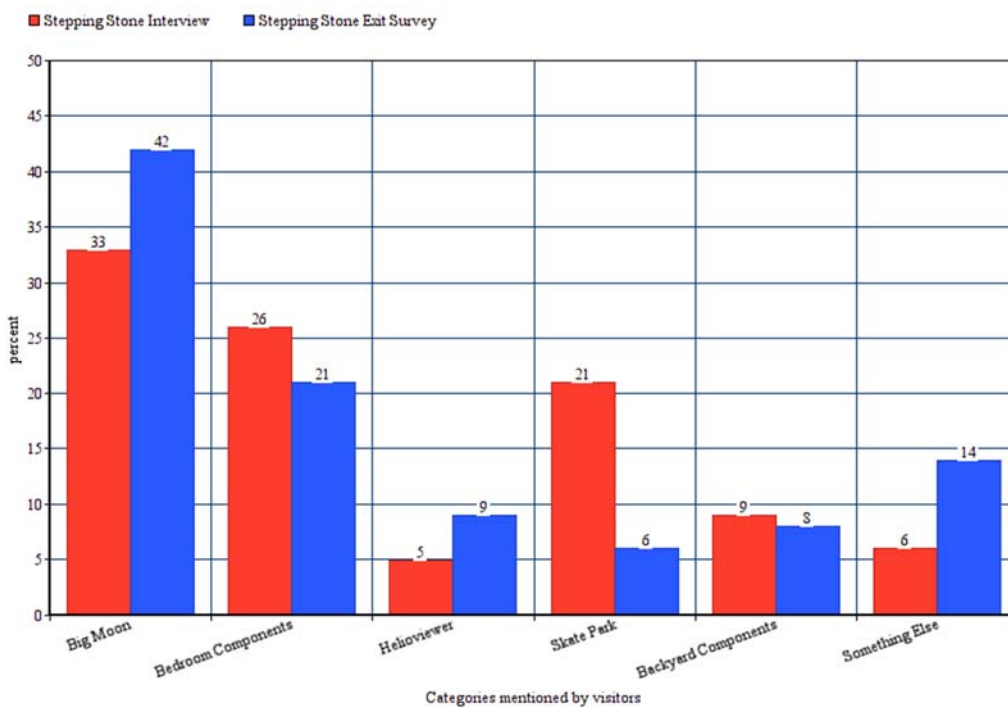
Comments about the Telescope from PCM include:

“The telescope was cool.”

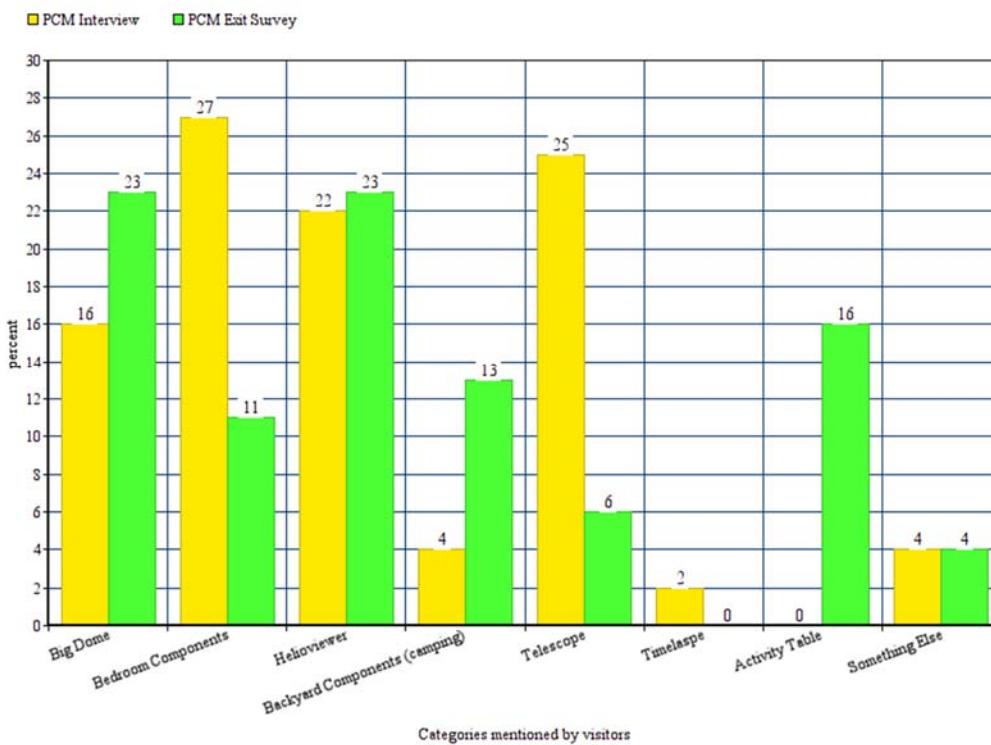
“The telescope because I have one at home.”

Data for memories for each area of the exhibit are presented below. They are displayed separately for each institution, as not every component was available at both sites.

What is one thing that you will remember most about your visit to My Sky?



What is one thing that you will remember most about your visit to My Sky?



It is evident from both surveys and interviews that several of the components were memorable. Each of these components was used by groups of children and adults together. These results are not surprising, given the popularity of these components during the remedial evaluation at BCM.

When asked how they would describe the exhibit to a friend, many visitors mentioned that it was about space, the sky, stars and even astronomy. Other visitors mentioned specific areas of the exhibit including components of the bedroom and the backyard.

At Stepping Stones, an average of 18% of visitors described the exhibit as being about space and 16% about the sky. An additional 17% described the exhibit as being about the moon, not unanticipated given the memorable nature of the Big Moon component. At PCM, an average of 15% of visitors described the exhibit as being about stars, 12% about the sky and 10% about the moon. These numbers are not surprising as stars are found in three of the most memorable areas – the Big Dome, the Telescope and the Bedroom (in Constellation Creation and above the bed).

In addition to these more concrete descriptions, several visitors described qualities of the exhibit such as exciting and magical.

“It was fun and interactive.”

“It was stimulating and fascinating.”

“Lots of fun things to try.”

“A way for small children to experience the wonder of looking up at night.”

“Fascinating for kids.”

Others described their experience in the exhibit as informative and educational.

“It’s a great place to learn.”

“So much to learn in a fun way.”

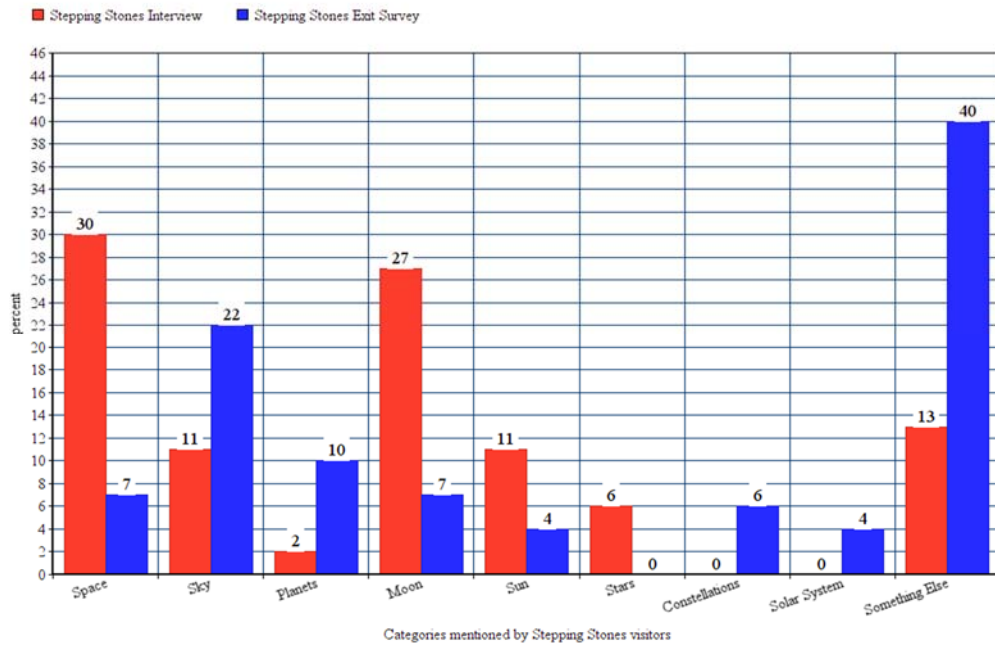
“A great learning experience for kids while having fun doing it.”

“A great way for kids to learn about the sky.”

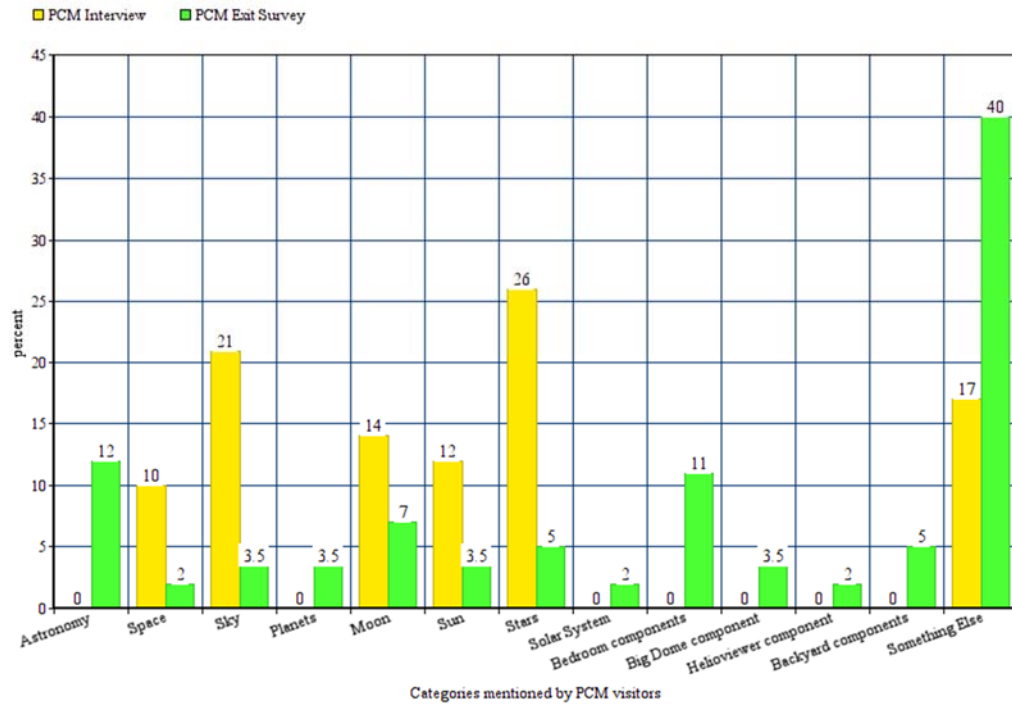
“Teaching the kids about the night sky and what we find in it.”

Data representing the variety of categories mentioned by visitors are presented below for each site. The “something else” category includes the above descriptions of qualities of the exhibit as well as comments about the educational value of the exhibit. It is encouraging that so many visitors remarked on the educational value of the exhibit and saw it as a place for their children to learn.

If you were to describe this exhibit to a friend, what would you say about it?



If you were to describe this exhibit to a friend, what would you say about it?



Perceptions of the Sky

A primary message of the exhibit is that the sky is a free and enormous learning resource, and it is available to all of us, all of the time. To determine how visitors perceive the sky, the question was asked: Why do you think the people who made this exhibit named it *My Sky*?

While many visitors depicted the exhibit as being about the sky (18% at Stepping Stones and 30% at PCM), or space (13% at Stepping Stones and 19% at PCM) others described actual activities that one can do in the exhibit (32% at Stepping Stones and 6% at PCM). Many visitors (20% at Stepping Stones and 16% at PCM) really thought about the name and made note that it was named such because the sky can be viewed by all of us. Comments include:

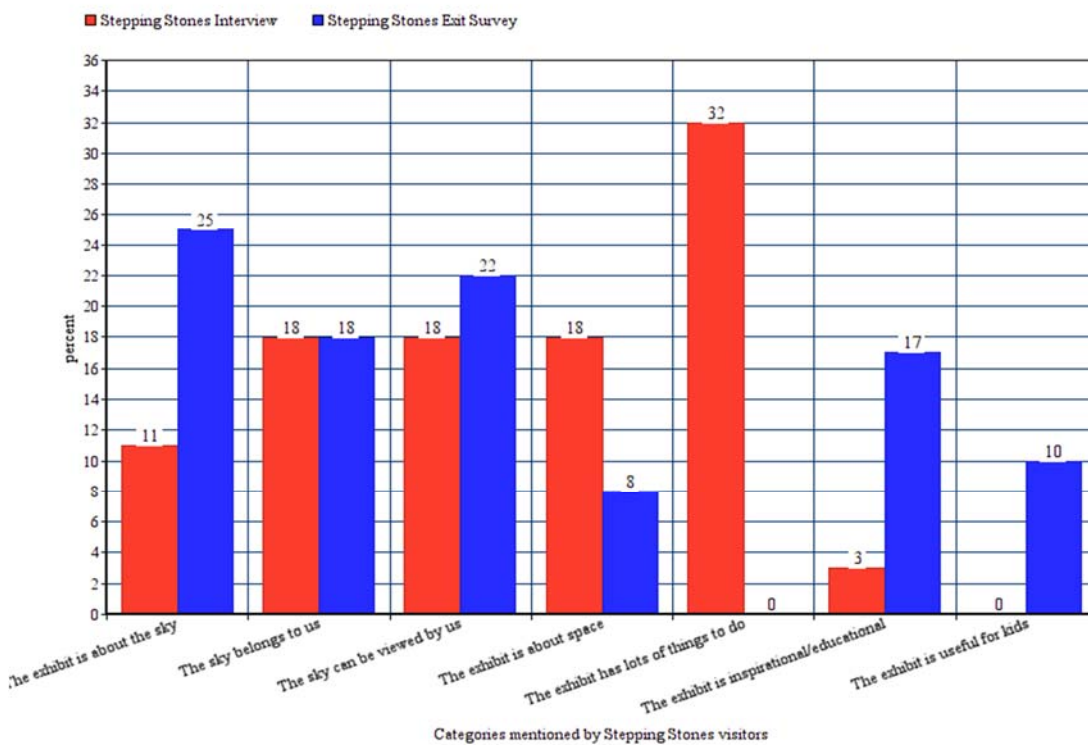
“A lot of people see it.”
“If you look up, you see the sky.”
“It’s what we can see.”
“Everyone see the sky differently.”
“We all look up at the same sky.”

Others (18% at Stepping Stones and 27.5% at PCM) reported that the exhibit is called *My Sky* because the sky belongs to all of us:

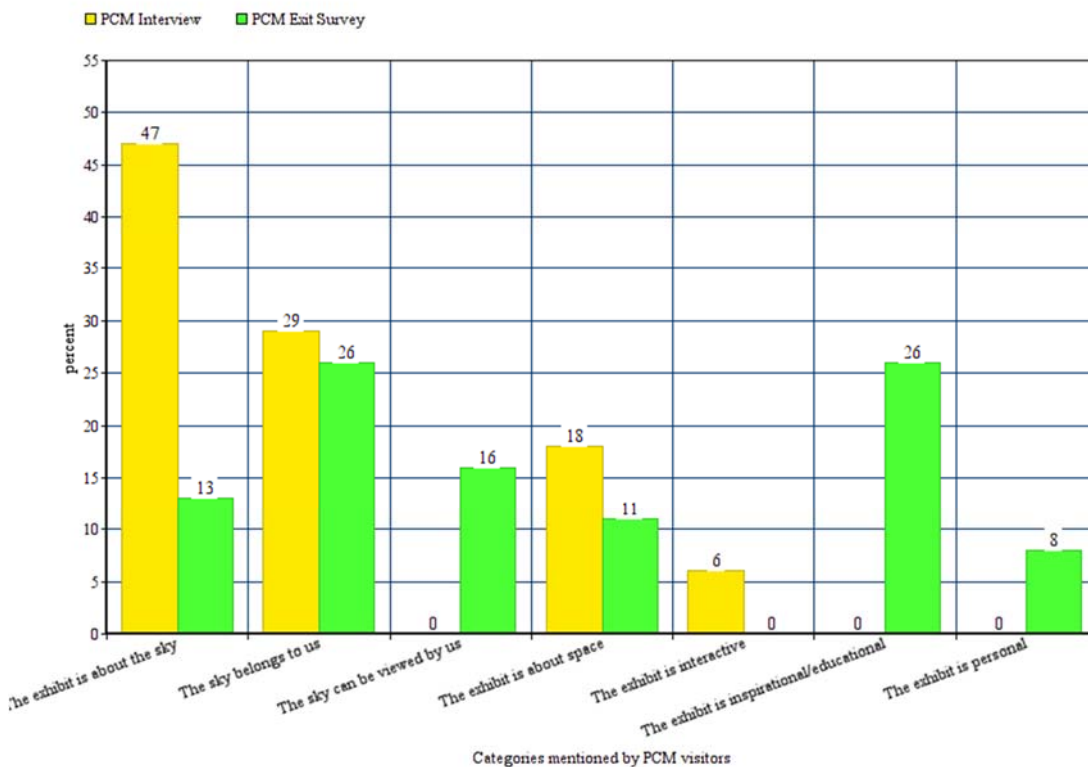
“It’s our sky.”
“It's all about what we see in our sky.”

Additional responses are presented for each site. It is clear that visitors not only understand from name or from activity that this exhibit is about the sky but also that the sky is a resource for all of us. It is encouraging that many visitors also found the exhibit to be inspirational or educational and that the exhibit was useful and personal.

Why do you think the people who made this exhibit named it My Sky?



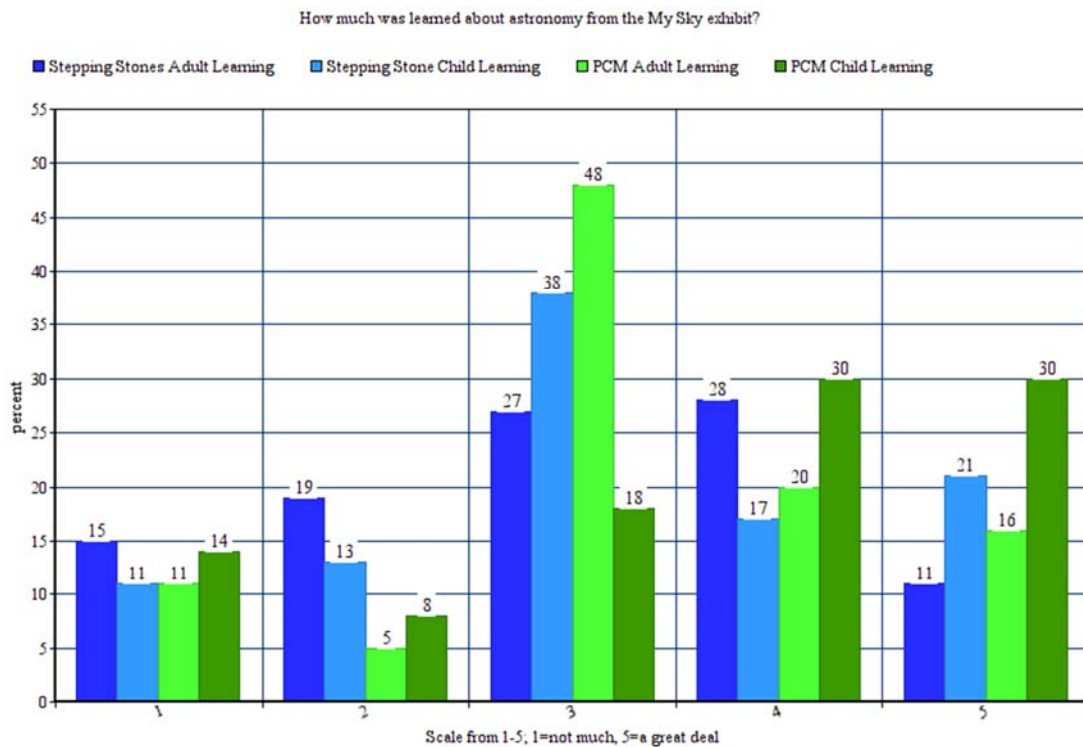
Why do you think the people who made this exhibit named it My Sky?



Learning Astronomy in *My Sky*

A second message of the exhibit is that it's not just fun to look up at the sky, doing so allows you to learn about and practice science. Adult visitors reported that they learned some science and that their children learned a great deal of science in the exhibit.

Approximately 84% of adults at PCM and 66% of adults at Stepping Stones indicated that they learned at least some science during their time in the exhibit, and 78% of adults at PCM and 76% at Stepping Stones reported that their children learned at least some science at the exhibit.



During interviews, visitors were more specific about the topics of their learning. Almost half (48%) of Stepping Stones adults interviewed indicated that they learned something new about the moon, while 21% reported that they learned something new about shadows. An additional 14% of adults learned something new about the sun. Adult visitors at PCM also gleaned new information about the sun with a full 45% mentioning that they learned something new about the sun from the Heliviewer. Many adults here (46%) also noted that they learned about the stars. As for the children visiting the exhibit with these adults, 77% of those visiting *My Sky* at Stepping Stones learned about the moon, from the Big Moon exhibit and from the Orrery component – as reported by their parents. An additional 15% learned about the sun. At PCM, 100% of children learned

about stars. It should be noted that there were very few respondents to this question at PCM as most of those interviewed were children.

Visitors from both sites commented on learning about the sun:

“The sun has flares.”

“The sun is really cool.”

“The sun explodes.”

“Things shoot out from the sun.”

“I loved the sun, different things about the sun than what you usually see.”

Visitors from Stepping Stones mentioned learning about the moon (Big Moon component):

“The moon is really big.”

“Why you see only one side of the moon”

“The texture of the moon.”

Visitors from both sites mentioned learning about the moon from the Orrery component:

“When the earth and the moon turn, the moon gets smaller because of the angle you see it at (orrery).”

“I was able to see the moon when it was almost full (orrery).”

“About the cycles of the moon (orrery).”

Visitors from both sites commented about the stars (Constellation Creation component/Telescope at PCM):

“There are lots of constellations in the sky.”

“Constellations are special stars you can see in the sky.”

“You can see stars through the telescope.”

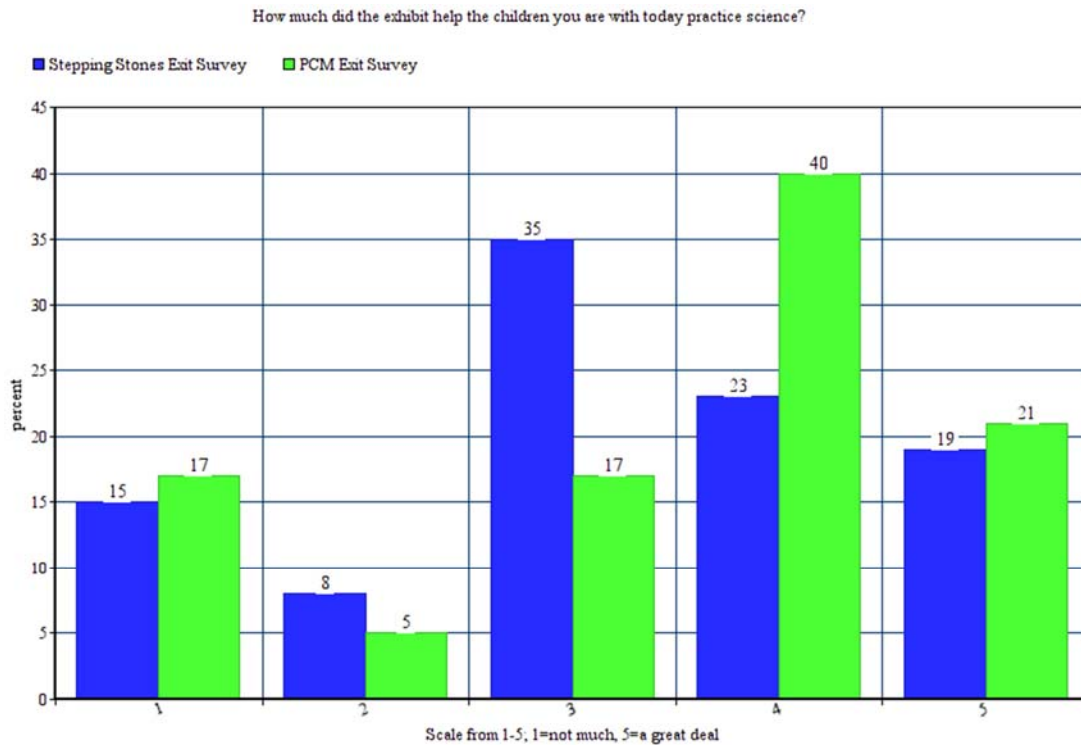
Visitors at Stepping Stones also commented on shadows (at the sundial component):

“I learned how a sundial works.”

Practicing Foundational Science Skills

One of the exhibit team’s primary goals for the exhibit is for children to practice foundational science skills with their adult caregivers during their time at the museum and for adults to help their children observe, notice patterns, make predictions, communicate their observations and imagine. A main message of the exhibit states that: “when kids look up at the sky, make observations, talk about what they observe, they are practicing science skills. And when you encourage them to practice these skills, you are helping them to develop as scientific thinkers.”

Adults indicated that the exhibit did in fact help the children they were with practice science skills. Of PCM adult visitors surveyed (61%) and 43% of those at Stepping Stones reported that their children practiced science at the exhibit.



During interviews, parents concurred with the survey results. They also provided specific examples of how their children practiced science skills during their visit. Half (50%) of adults interviewed at Stepping Stones indicated that their children practiced observation skills, 25% of these specifically practicing this skill at the moon components and an additional 25% practiced observation skills while looking at the sun (Helioviewer). A number of parents (20%) also mentioned that their children practiced interacting with other children. At PCM, 75% of parents mentioned that their children practiced observing - a third of these children practiced this skill while looking at the sun. Twenty-five percent of parents also reported that their children practiced using their imaginations.

Visitor comments from both sites support the practice of science skills:

“They learn by doing – they learned a lot about the earth-moon-sun (orrery).”

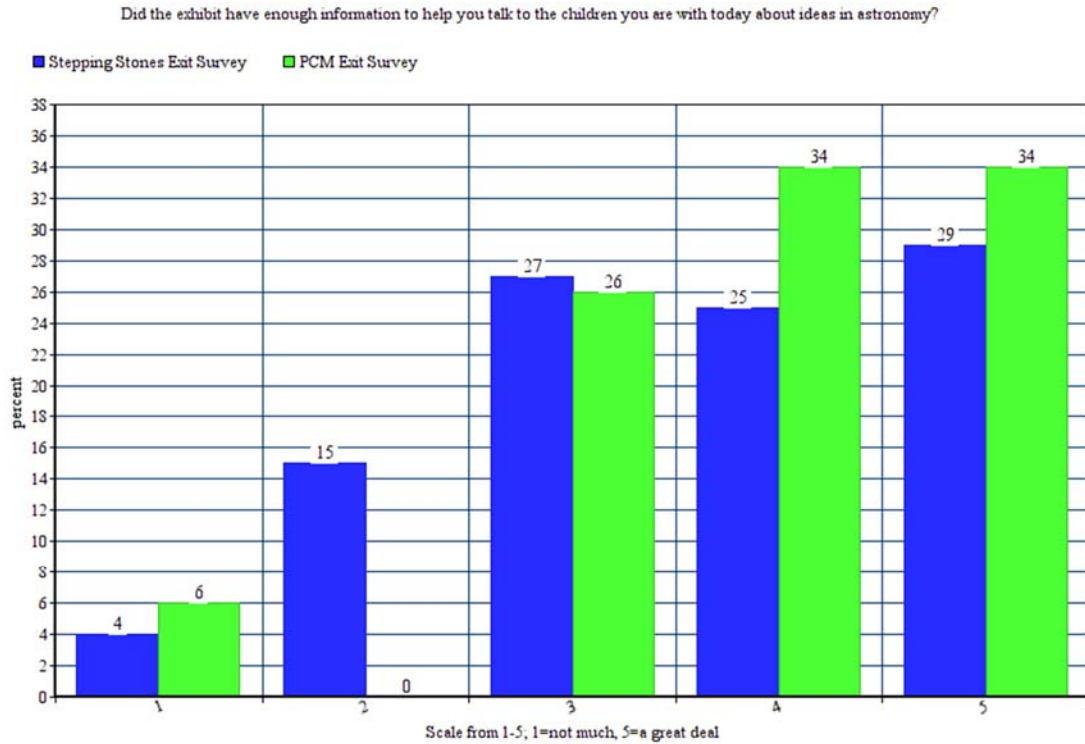
“He was spinning the moon by himself and observing.”

“She was feeling the moon and using her imagination to try to find faces.”

“At the sun we noticed the flares.”

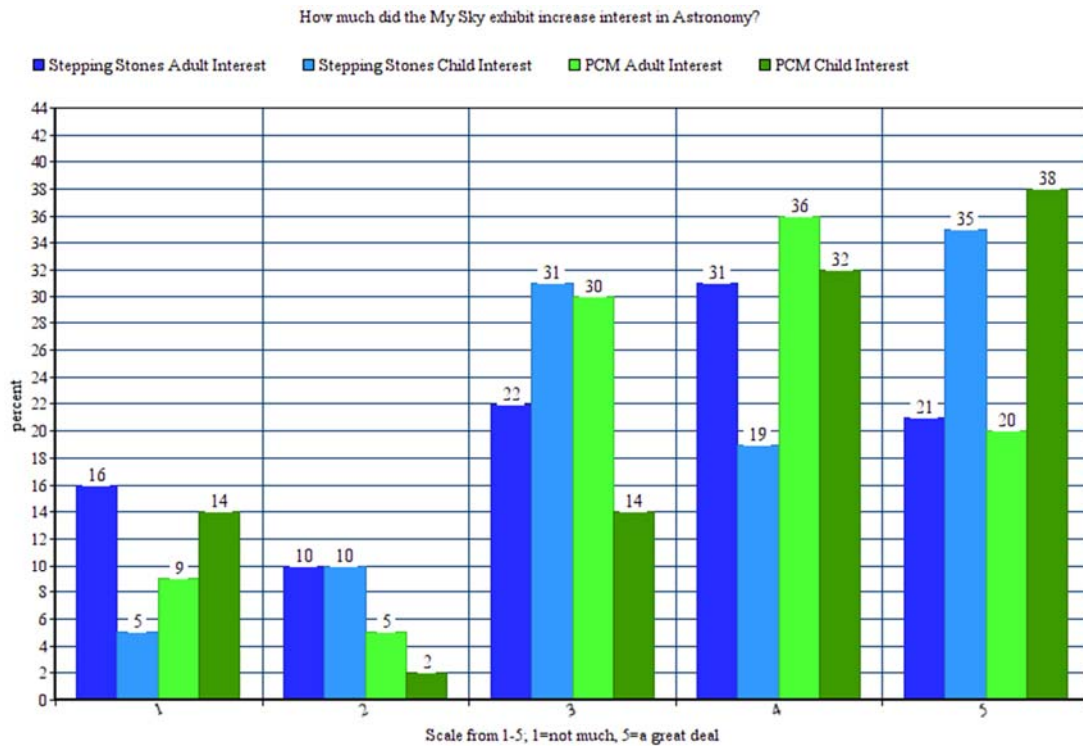
“We watched the videos of the sun.”

The exhibit team also wanted to know if parents were able to use information presented at each component to engage their children in these skills and with NASA content. A majority (84%) of the adults surveyed at PCM and 71% at Stepping Stones indicated that they were provided with sufficient information to help them talk to their children about ideas in astronomy.



Interest in astronomy

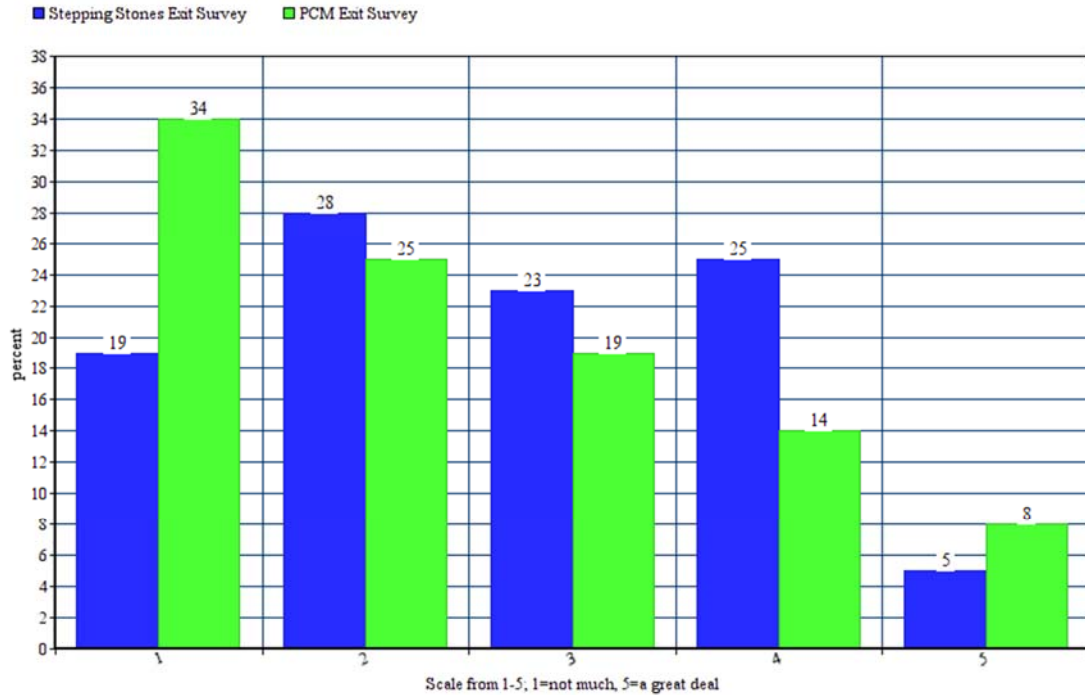
In addition to learning about astronomy and practicing science skills in the exhibit, visitors of all ages increased their interest in astronomy after visiting the exhibit. Over half (56%) of adults at PCM and 51% at Stepping Stones increased their interest in astronomy after visiting the exhibit. For children, the numbers were greater at PCM with a full 70% of parents indicating that their children's interest in astronomy had increased. Additionally, 54% of parents at Stepping Stones felt that their children's interest in astronomy had gone up after their visit.



Connection to NASA

The exhibit team was also interested in learning if parents were able to make connections between the *My Sky* activities and NASA research. This is the one area that could be improved upon. When asked how much they learned about scientists, artists, or other people who are inspired by the sky from the *My Sky* exhibit, 59% of PCM adults surveyed and 47% of adults at Stepping Stones felt that they did not learn much about these people from the exhibit.

How much did you learn about scientist, artists, or other people who are inspired by the sky from the My Sky exhibit?



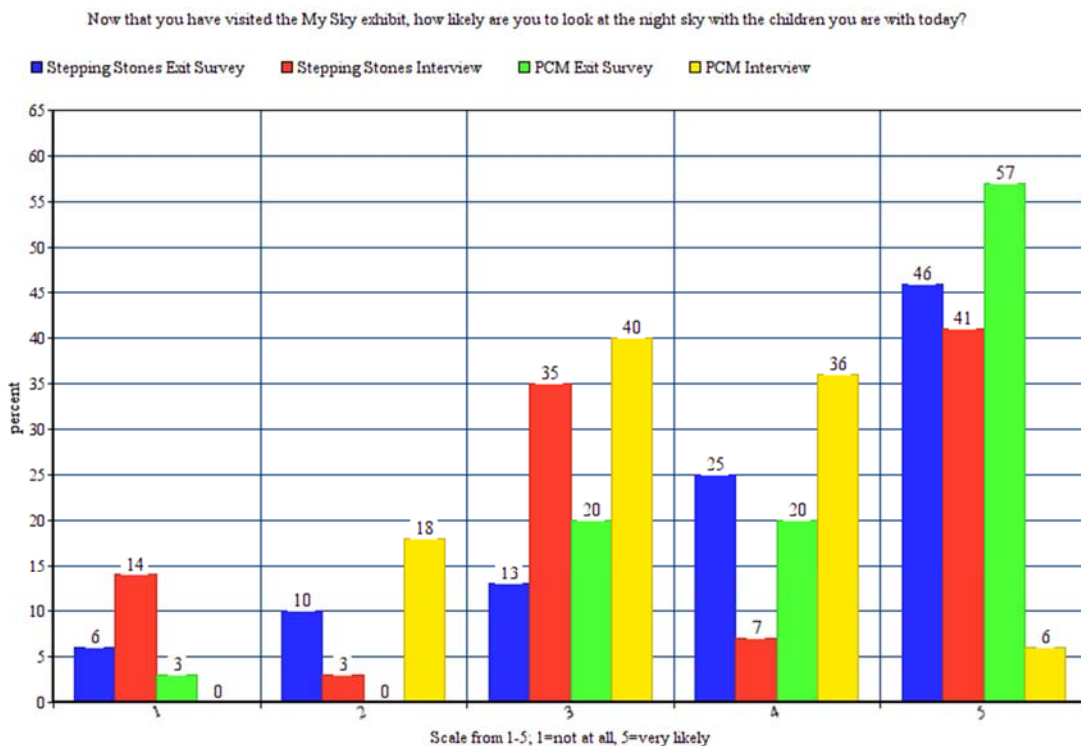
Several labels throughout the exhibit depicted stories of scientists, artists, or other people who are inspired by the sky. Unfortunately, these were read by very few adults. Only 14% of adults interviewed at Stepping Stones had seen at least one story, and no respondents from PCM had seen the stories.

Connections to the Sky Beyond the Exhibit

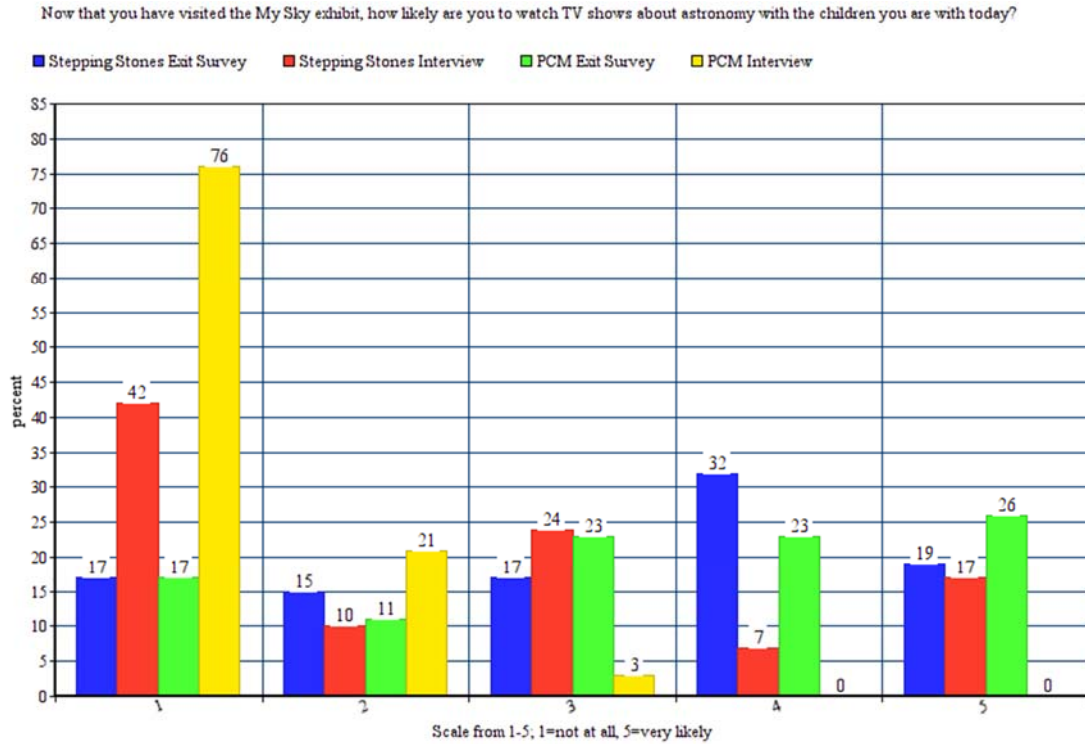
An important message of the exhibit is to look up at the sky together. Families are encouraged to “look up” not only when they visit the exhibit, but also in their everyday lives. Visitors were asked if any of the activities in *My Sky* reminded them of experiences they have had outside the museum. The majority (88%) of those interviewed at Stepping Stones and 42% of those at PCM indicated yes, citing examples including camping, skateboarding, and looking at the stars or the moon. A number of visitors also mentioned owning a telescope at home.

Visitors were also asked during interviews and via surveys how likely they were to try a variety of astronomy related activities with the children outside of the museum now that they have visited the exhibit.

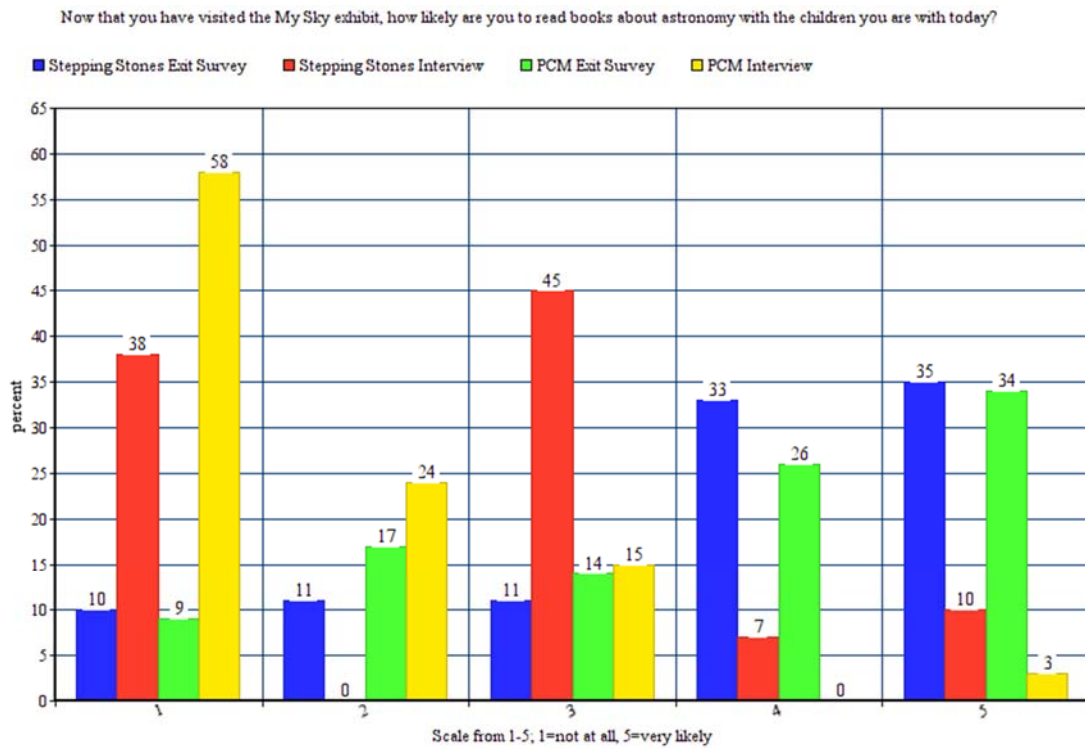
Visitors at the both museums indicated that they would be interested in looking at the night sky with their children. Over 70% of survey takers and close to half of those interviewed indicated that they would in fact look at the night sky after visiting the exhibit.



Approximately half of those visitors completing surveys were likely to watch TV shows about astronomy after visiting the exhibit. Less than 20% of visitors who were interviewed indicated that they were likely to watch astronomy TV programs.

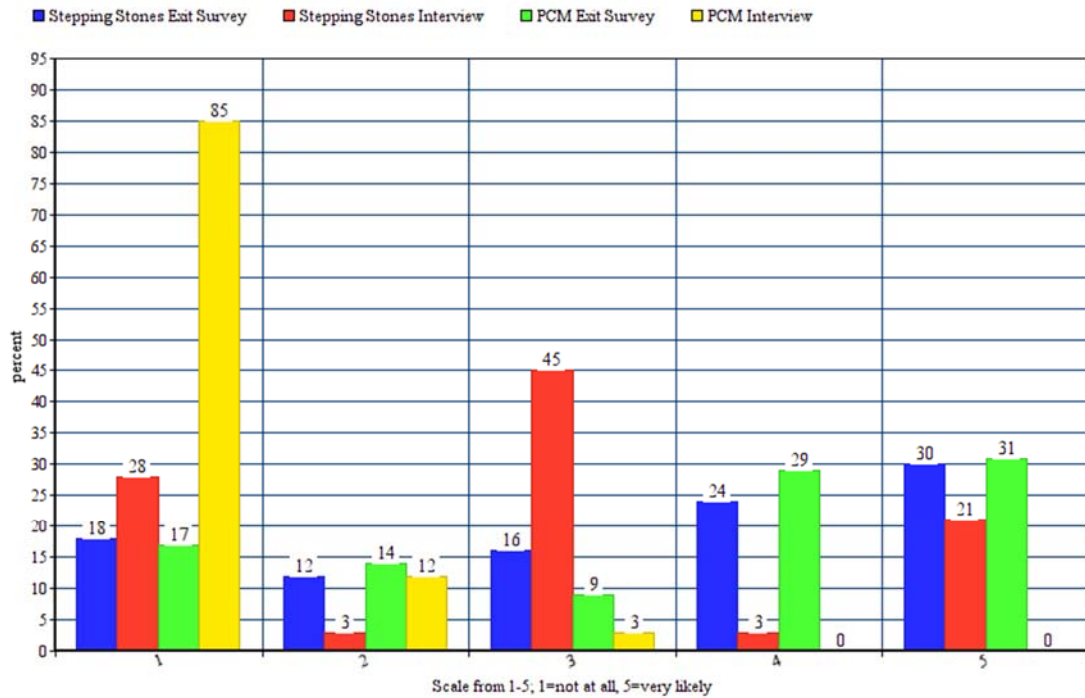


Sixty percent of PCM visitors and 68% of Stepping Stones visitors reported in surveys that they would read books about astronomy after visiting the exhibit. Far fewer interviewed visitors (3% at PCM and 17% at Stepping Stones) indicated that they would read after visiting the exhibit. A section of the *My Sky* exhibit included a comfortable space for reading books. Several children’s books were available for adults and children to read while visiting the exhibit.



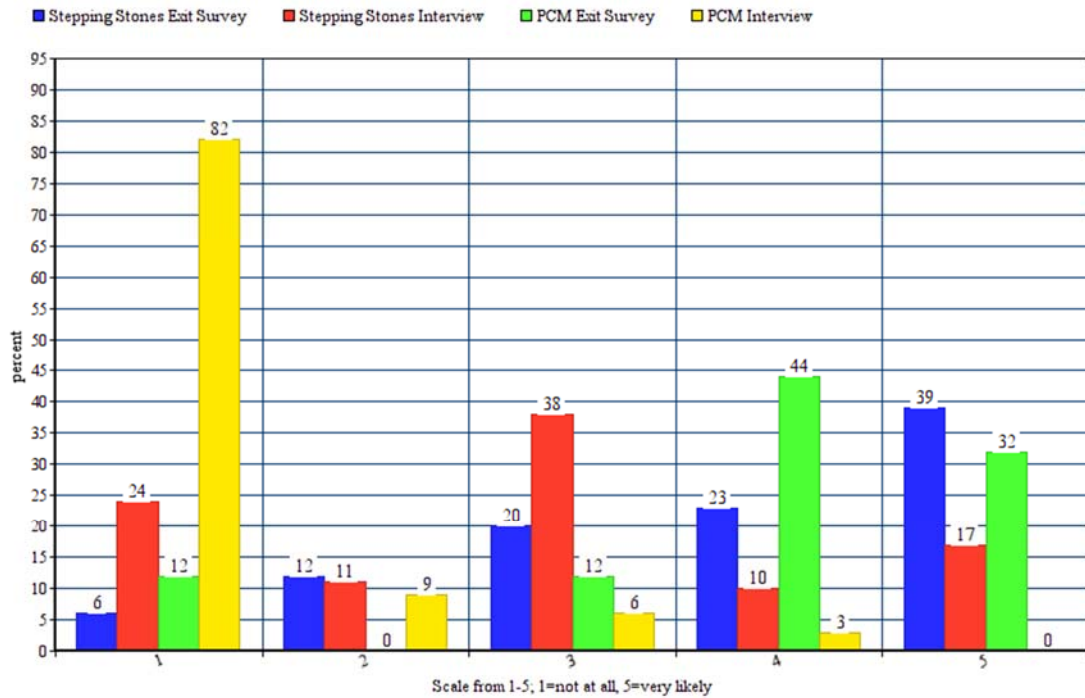
While over half of survey responders indicated that they would go to websites to learn new things about astronomy with their children after visiting *My Sky*, less than one quarter of those interviewed reported an interest in this activity. Many adults did indicate that they use astronomy apps on their phones and use their phones to look up astronomy related questions that they or their children have.

Now that you have visited the My Sky exhibit, how likely are you to go to websites to learn new things about astronomy with the children you are with today?



Finally, visitors were asked if they would play games or engage in hands-on activities about astronomy after their visit. To encourage this behavior, interview participants received a “goody bag” filled with astronomy-related activities to do at home. Over 70% of survey respondents indicated that they would be interested in this activity, while less than 20% of those interviewed responded with interest in this activity.

Now that you have visited the My Sky exhibit, how likely are you to play games or other hands on activities about astronomy with the children you are with today?



Engagement at Specific Areas of the Exhibit

Over the course of the remedial evaluation, the theme of positive and engaging interactions between children and adults emerged. During the exhibit's stay at BCM, there were a number of exhibit components that engaged both parents and children, specifically the Bedroom, (including the Orrery, and Constellation Creation), the Telescope and the Heliviewer. At these components, adults were observed participating in and conversing about the activities with their children. The summative evaluation sought to determine if these interactions occurred in other museums as well. From observations and interviews with visitors, several categories of behaviors were identified at each area of the exhibit. Visitors either did not visit an area or if they did they participated in the activity by themselves, with someone else, or watched someone else in their group participate in the activity.

At the Skate Park (Stepping Stones), 7% did not visit the area; 41% participated in the activity by themselves; 34% participated with someone else in their group; and 7% watched someone else do the activity. Some of the interactions were between adults and children but many were between children and other children. Interactions varied between visitor groups. During the follow-up interview, 33% mentioned shadows while 23% did not notice the shadows. Twenty-seven percent of visitors used the lever but did not make the connection to the shadows. Six percent did use the lever appropriately and make a connection between the lever and the shadow activity and 13% of visitors were not sure how the activity worked.

At the Big Moon (Stepping Stones), 45% participated in the activity by themselves; 46% participated with someone else in their group; and 5% watched someone else do the activity while 4% did not visit the area. Like the Skate Park, some were parent child combinations. Many parents stayed outside of the dome while their children explored inside. During an interview, 45% described physical aspects the moon such as the craters or the rough surface, 38% spun the moon or described the spinning aspect of the moon, 28% mentioned that they learned something about the moon and 14% reported seeing the stars on the wall. Visitors were asked what they remembered most about this area. Comments include:

“That was the moon, you could spin it, it told about dark spots.”

“It had lots of holes and dents and stuff.”

“When it spins, you can see where the little dents were, it felt bumpy.”

“It felt like you were orbiting around the moon in space.”

“Stars on the wall made it feel like you are in space.”

At PCM, this component consisted of the Big Dome without the Big Moon. A large flat moon image was placed on the floor and an audio track describing the moon could be played by visitors. Over half (58%) of the visitors taking part in the evaluation participated in this activity with someone else (mostly other children); 24% entered the dome alone, and 18% did not visit the activity. Most of these visitors (63%) ran in and out of the dome without looking at the moon or listening to the audio. Almost one quarter

of visitors did make mention of the stars in the dome. They found these aspects of the area memorable:

“It was dark in there.”

“There are lots of stars.”

“It’s big and there’s talking inside.”

“I looked for the bunny parts.” (mentioned in audio)

At Stepping Stones, 44% of visitors did not visit the Heliviewer while 22% did not visit at PCM. Eleven percent participated in the activity by themselves at Stepping Stones and 9% participated alone at PCM. Forty-one percent participated with someone else in their group at Stepping Stones while a full 69% participated with another member of their group at PCM. Finally, 4% of visitors at Stepping Stones watched someone else in their group do the activity, and 0% watched others at PCM. Like at BCM, the majority of the interactions were between parent and child. During the interview, adults and children alike described the activities they did at the component, discussed features of the sun (flares) or how different it looks. Most visitors did not know how these images were taken or how they were made but they did learn new things about the sun and commented on these memorable features:

“The moon going in front of the sun.”

“It’s called the moon transit.”

“These are real pictures taken by NASA.”

“The big flares.”

“This is the sun, it’s real images of the sun.”

“I like the sun making explosions.”

“This is what the sun actually looks like.”

“They show you different times and different years, solar flares or how Venus travels and it tells you in Spanish and English.”

“When it spun, little pieces of the sun shot out.”

At Stepping Stones, visitors entering the Backyard could sit by a campfire and watch stars move across the sky by watching the Time Lapse video. At PCM, visitors could pretend to camp but not watch the video due to space constraints. The Telescope activity was located near the backyard at PCM. At Stepping Stones 38% of visitors did something alone in the space (mostly children) while 17% did an activity with someone else in their group – again mostly children interacting with other children. Four percent watched someone else do the activity and 33% of visitors did not visit the space. Of those visitors who did visit the space, 70% played in a tent; 22% specifically mentioned the music in one of the tents; 30% watched the time lapse and 4% observed something in the tree. At PCM, over half of visitors (55%) did an activity with someone else in their group while 21% did an activity on their own. Twelve percent watched someone else do an activity (usually a parent) while 12% did not visit this area of the exhibit. Of those who did visit, 75% mentioned playing in the tent and 29% specifically mentioned the music. Over half of visitors (58%) mentioned looking through the telescope and 18% mentioned doing

something at the (interpreter led) activity table located near the backyard. The Time Lapse was located across from the backyard on the other side of the exhibit. This location proved difficult as 73% of visitors did not visit this component. Of those who did, 77% did the activity with someone else and 23% did it on their own. The most memorable aspects of this area of the exhibit include:

“I went in the other tent and played in the sleeping bags.”

“The tent and the songs”

“We toasted marshmallows by the fire.”

“We pretended to camp.”

“The tents were fun.”

“I played music in the tent.”

“On the screen, it told you facts, showed different times of day and how fast clouds move.”

“You can see how the sky changes from day to night.”

“I liked how the sky changed.”

“I found a gnome.” (from Time Lapse)

“You can see a bunch of stars.”(through the telescope)

“Mom, you have to see this!” (at the telescope)

“The stars looked like they moved across the sky.”

In the Bedroom area of the exhibit, people can create their own constellations, explore different phases of the moon, and climb into a bunk bed. At Stepping Stones, 52% of visitors did at least one of the activities with someone else in their group, 35% did an activity on their own, and 4% watched someone do an activity. Only 9% of visitors did not visit this area. During interviews, 65% mentioned or described the Constellation Creation activity, 51% mentioned or described the Orrery and 29% climbed into the bed. At PCM, 70% of visitors did at least one activity with someone else in their group, while 21% did an activity on their own. Again here only 9% of visitors did not visit this area of the exhibit. Of those interviewed, 68% mentioned or described the Orrery, 45% mentioned or described the Constellation Creation and 62% climbed in the bed.

Visitors from both sites commented on memorable components of the bedroom. At the Constellation Creation, visitors said:

“I like doing the strings.”

“The thing where you can make pictures with ropes.”

“You can make constellations with bands. I made a dog.”

“I made an “M” with the strings.”

“I made a square and a kite.”

“I made shapes – diamonds and rectangles.”

“I made a carrot.”

“I made the Big Dipper.”

While most of these creations were not known celestial objects, there were created from the imaginations of the children participating in the activity.

The bunk bed was a memorable experience for many children. This component afforded turn taking and role-playing. A few visitors did mention stars and space when describing what they did in the bed:

“From the top of the bed it looked like we were in space.”

“We saw all the stars.”

“The pillows felt like space.”

The Orrery was also a popular destination and visitor comments indicate that there was learning occurring at this component:

“You can use the crank so you can see the moon in the window.”

“The moon was spinning around the earth.”

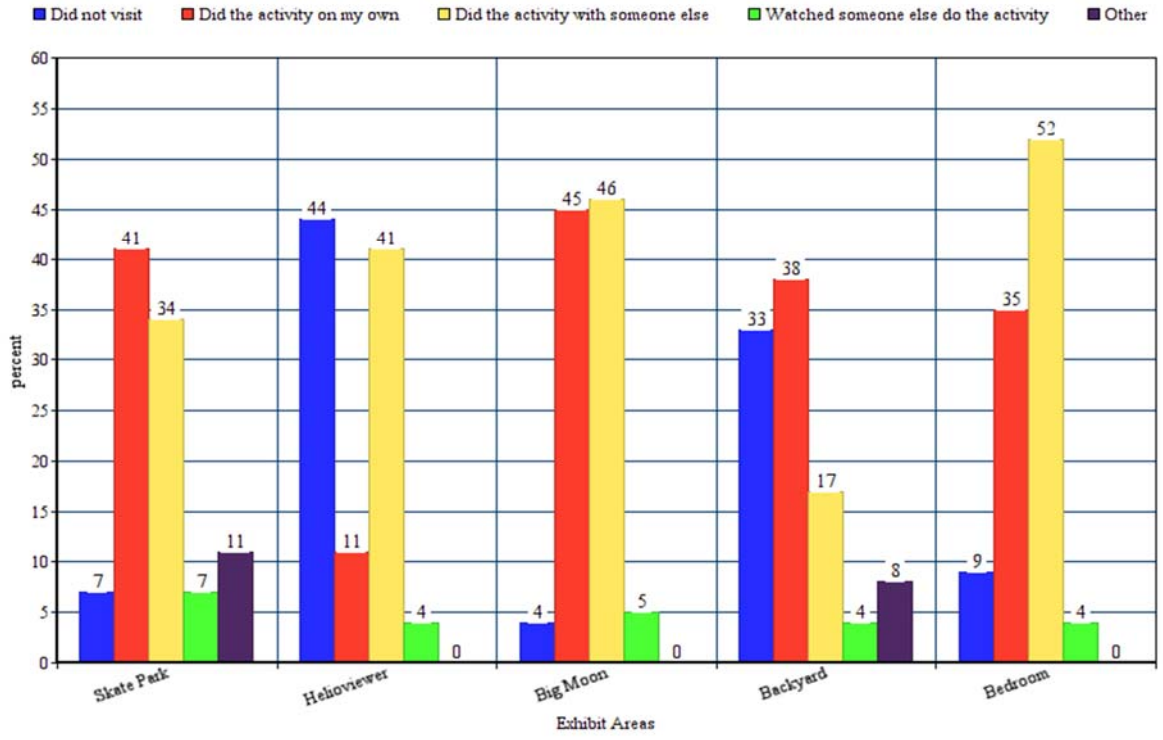
“I turned it and when I looked up at the window I saw it changing.”

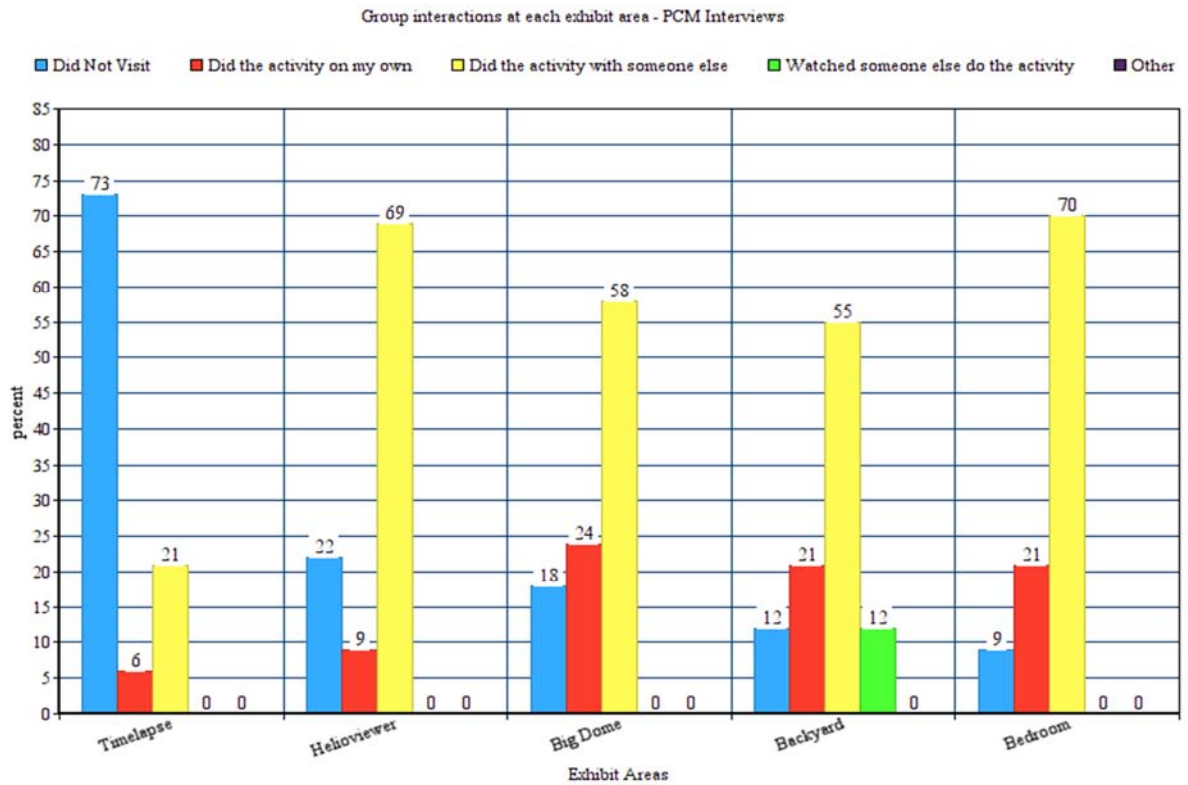
“I liked making the earth and moon spin.”

“It's really cool because you can see it in the window and see the earth and moon and sun.”

Below are graphs representing the types of interaction that occurred at each area of the exhibit for each institution. The most visited areas at Stepping Stones were the Big Moon, the Skate Park and the Bedroom. For PCM, the most visited areas were the Bedroom and the Backyard. At Stepping Stones, many visitors engaged in an activity with other visitors in all of the areas of the exhibit except for the Backyard, while very few watched others do an activity. At PCM, many visitors engaged in an activity with other visitors in all of the areas except for the Time Lapse. Here again, very few visitors watched others.

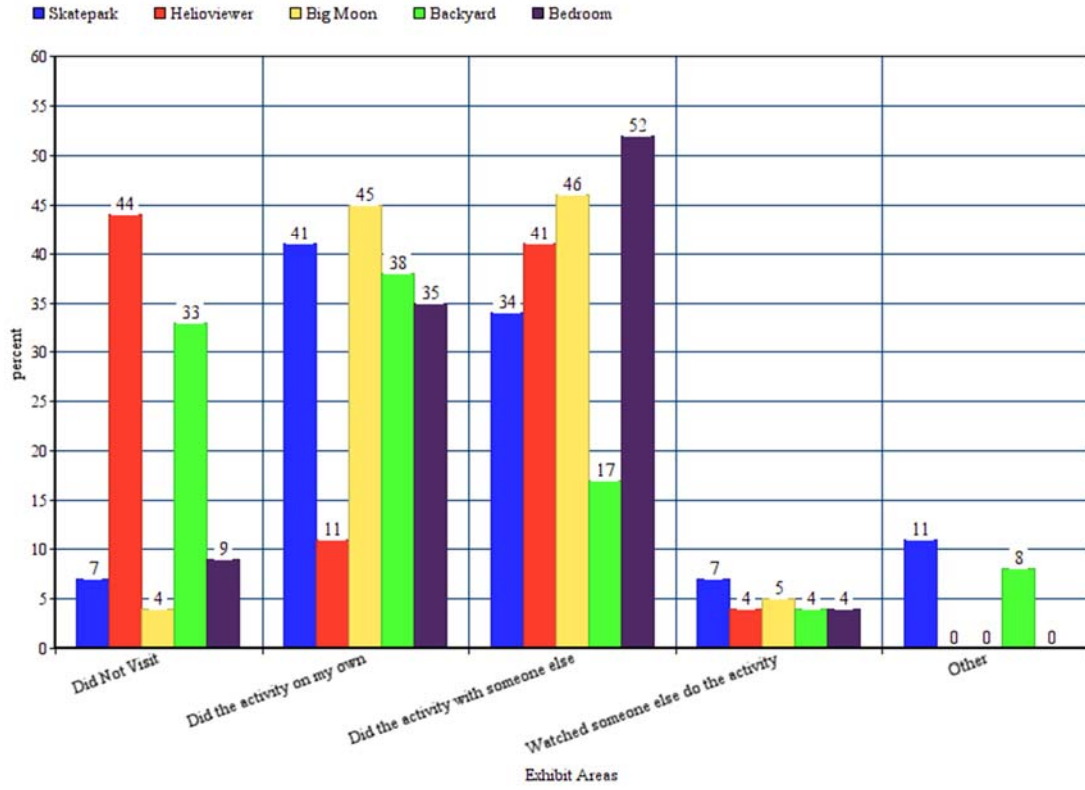
Group interactions at each exhibit area - Stepping Stones Interviews



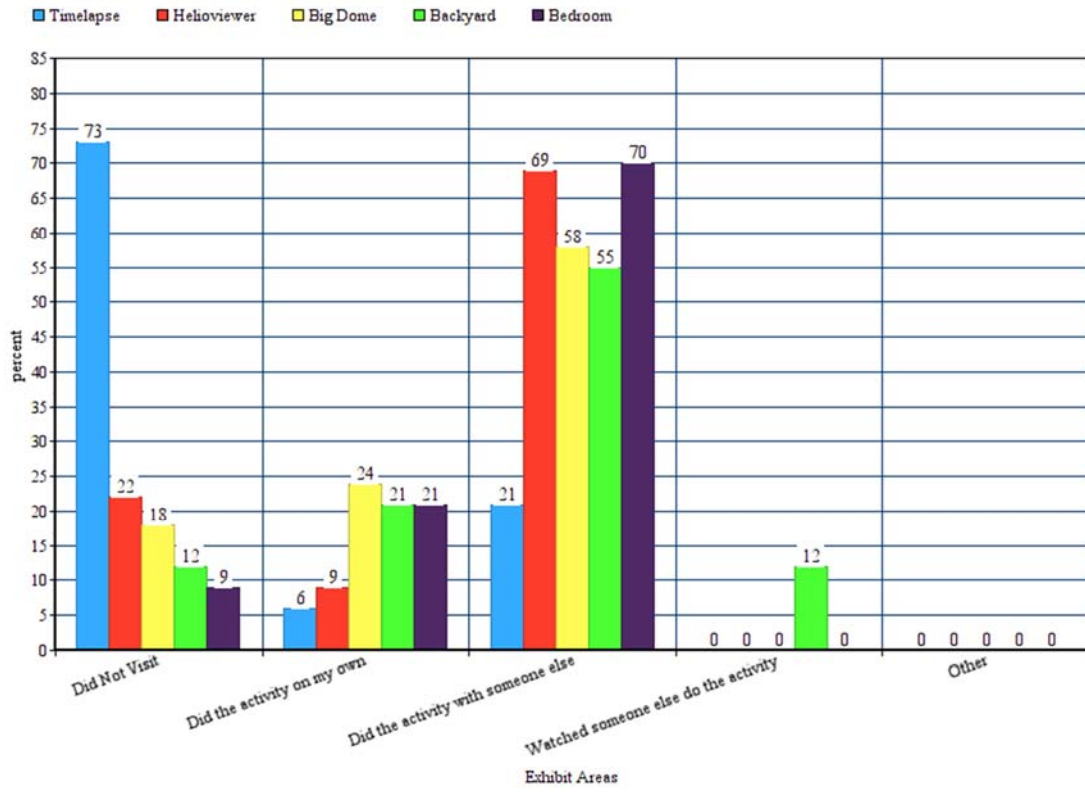


This second set of graphs displays the same information but highlights the overall interactions at each museum. This graph shows that while some visitors did not visit certain areas of the exhibit - Heliviewer and Backyard for Stepping Stones, and Time Lapse for PCM, many visitors interacted with others in most areas of the exhibit. Adult child combinations were most often observed at the Heliviewer, the Bedroom and the Big Moon. These data concur with data collected during the remedial evaluation at BCM. These areas are also where much of the astronomy learning takes place and foundational science skills are practiced.

Group interactions at each exhibit area - Stepping Stones Interviews



Group interactions at each exhibit area - PCM Interviews



Conclusions

Because the remedial evaluation was so extensive at BCM, and many of the recommendations from this evaluation were incorporated into the final exhibit, there were no major surprises in the summative evaluation. The components that were most successful at BCM continued their success at Stepping Stones and PCM.

Based on the findings from all of the studies, the exhibit was successful in engaging children in developmentally appropriate science content and inquiry. The exhibit was engaging! Visitors of all ages were interested in the *My Sky* exhibit and in the topic of astronomy. Several of the components were memorable including the Big Moon and activities in the Bedroom. Visitors commented that it was fun and interactive, and a great place to learn. Over half of the visitors at both Stepping Stones and PCM reported that their interest and their children's interest in astronomy increased after visiting the exhibit.

The exhibit was extremely successful in helping children acquire knowledge and skills that lead to appreciation for and understanding of astronomy and encouraging parents to actively collaborate in their child's science inquiry as co-learners. Both adults and children learned at the exhibit and families practiced foundational science skills together. At many of the components, parents and children worked together and did not shy away from components that included science content. Spending time with the components during each of the evaluations also led to gains in science knowledge of visitors as observed by the evaluator during the formative and remedial evaluations and from the surveys and interviews conducted during the summative evaluation. Adult visitors indicated during the summative evaluation that they learned some science and that their children learned a great deal of science in the exhibit. Adults also reported that they observed their children participating in foundational science skills. Equally as important, the evaluator observed parents and children practicing these skills together at several components.

The exhibit was also successful in helping adults recognize connections between this exhibit experience and science learning opportunities in their everyday lives. Many adults, and children, made connections between things they saw and did in *My Sky* and things they do at home or at school. Activities ranged from looking up at the night sky to reading books about astronomy. Children also reminisced about camping trips and things they had learned about the moon and the sun at school.

Finally, the exhibit did make strides to help parents make connections between the sky they observe with their children and the sky observed with NASA instruments. Two of the most popular areas of the exhibit, the Helioviewer and the Big Moon had direct connections to NASA. Several labels throughout the exhibit also depicted stories of scientists, artists, or other people who are inspired by the sky. The exhibit team spent a great deal of time identifying, locating and interviewing these individuals. Unfortunately, very few adults read these stories, as the labels depicting them appear to be too small and too dark for visitors to read. For future venues, if funding allows, the exhibit team might consider reprinting the labels using a larger font size and a brighter background.

Overall, the exhibit was extremely successful. It afforded adults and children the opportunity to explore a resource – the night sky, which is readily available to them. Together they learned about astronomy, practiced foundational science skills and participated in a variety of astronomy related activities outside of the museum after they visited the exhibit.

APPENDIX A: SAMPLE INTERACTIVE INFORMATION SHEET

TITLE OF UNIT: Constellation Creation

DESCRIPTION:

In a mockup of a child's room, families will encounter a star field poster and will be challenged to invent new constellations with transparencies of images familiar to them...Justin Bieber, Dawson from Dawson's Creek, Alf, a jet ski, an artichoke, etc. Pop culture people and objects will add a whimsical element to this game.

INTERACTIVE PIECES:

Star Field Map

Transparencies

Constellation sheets (with no lines or constellation names)

Markers

VISITOR INTERACTIONS:

The following is a list of various ways visitors should be able to participate with unit:

- Match transparency line drawings with star plots on the star field map
- Create their own drawings on transparencies/tracing paper using the star field
- "Connect the dots" using the constellation sheets, inventing new constellations
- Name those new constellations
- Post new constellations on the wall with others

**Appendix B: Sample Observation Sheet for
Formative and Remedial Evaluations**

Constellation Creation Observation Sheet

Observer:

Date/Time observation began:

Visitor info, Adult: M F Parent/Grand/Other Caregiver

Visitor info, Child(ren): # of M _____ # of F _____

Age(s) _____

Amount of Time Observed:

Group was: _____ Cued _____ Uncued

Behaviors observed:

- Read OR listen to instructions
- Find (point to) known constellations (big dipper, Orion etc)
- Find (point to) sample constellation (my kite, broccoli pants)
- Make known constellations with elastics
- Make sample constellations with elastics
- Make own constellation with elastics
- Name their new constellations
- Adult tries out the activity
- Visitors uses the words “constellation”, “star” and “pattern” (circle words used)
- Other words/conversations related to the concept goals of the activity:

Observation Notes:

Interview:

1. What did you think about this activity?
2. Did you have any problems following the instructions for the activity?
3. What would you say the Museum is trying to show with this activity?
4. What could we do to make this activity better?

Appendix C: Exit Survey Form for Stepping Stones Museum

We hope that you have enjoyed visiting *My Sky*. Please take a few minutes to complete this survey to let us know what you think about the exhibit

1. What is one thing that will you remember about your visit to *My Sky* today?

2. If you were to describe this exhibit to a friend, what would you say it was about?

3. Why do you think the people who made this exhibit named it *My Sky*?

4a. Which areas of the exhibit/activities interested **you** the most? Check all that apply.

- The *Skate park* where people can explore their shadows
- The *Heliviewer* where people can see solar events like flares, and eclipses
- The *Big Moon* where people can touch craters, mountains and valleys of the moon
- The *Backyard* where people can sit and watch stars move across the sky
- The *Bedroom* where people can create their own constellations and explore different phases of the moon

4b. Which areas of the exhibit/activities do you think interested **the children** you are with today the most? Check all that apply.

- The *Skate park* where people can explore their shadows
- The *Heliviewer* where people can see solar events like flares, and eclipses
- The *Big Moon* where people can touch craters, mountains and valleys of the moon
- The *Backyard* where people can sit and watch stars move across the sky
- The *Bedroom* where people can create their own constellations and explore different phases of the moon

5a. How much did your visit to *My Sky* increase **your** interest in astronomy?

Not much	1	2	3	4	5	A great deal
----------	---	---	---	---	---	--------------

5b. How much did your visit to *My Sky* increase the interest in astronomy of **the children** you are with today?

Not much	1	2	3	4	5	A great deal
----------	---	---	---	---	---	--------------

6a. How much did **you** learn about astronomy from the *My Sky* exhibit?

Not much	1	2	3	4	5	A great deal
----------	---	---	---	---	---	--------------

6b. How much did **the children** you are here with today learn about astronomy from the *My Sky* exhibit?

Not much	1	2	3	4	5	A great deal
----------	---	---	---	---	---	--------------

6c. How much did the exhibit help **the children** you are with today practice science (watch closely, take a guess, test an idea, find a pattern use their imaginations)?

Not much	1	2	3	4	5	A great deal
----------	---	---	---	---	---	--------------

6d. How much did **you** learn about scientists, artists or other people who are inspired by the sky from the *My Sky* exhibit?

Not much	1	2	3	4	5	A great deal
----------	---	---	---	---	---	--------------

7. Did the exhibit have enough information to help you talk to the children you are with today about ideas in astronomy?

No, not enough	1	2	3	4	5	Yes, a great deal
----------------	---	---	---	---	---	-------------------

8. Now that you have visited the *My Sky* exhibit, how likely are you to try the following astronomy activities with the children you are with today?

a. Look up at the night sky

Not at all	1	2	3	4	5	Very likely
------------	---	---	---	---	---	-------------

b. Watch TV shows about astronomy

Not at all	1	2	3	4	5	Very likely
------------	---	---	---	---	---	-------------

c. Read books about astronomy

Not at all	1	2	3	4	5	Very likely
------------	---	---	---	---	---	-------------

d. Go to websites to learn new things about astronomy

Not at all	1	2	3	4	5	Very likely
------------	---	---	---	---	---	-------------

e. Play games or other hands on activities about astronomy

Not at all	1	2	3	4	5	Very likely
------------	---	---	---	---	---	-------------

9. Gender ____Female ____Male Zip Code _____

Ages of the children that accompanied you to *My*

Sky: _____

10. May we contact you to follow-up on your experience at the exhibit?

Yes: _____ email address: _____

No thanks: _____

Appendix D: Exit Survey Form for Providence Children’s Museum
My Sky

We hope that you have enjoyed visiting *My Sky*. Please take a few minutes to complete this survey to let us know what you think about the exhibit

1. What is one thing that you will remember about your visit to *My Sky* today?

2. If you were to describe the *My Sky* exhibit to a friend, what would you say it was about?

3. Why do you think the people who made this exhibit named it *My Sky*?

4a. How much did your visit to *My Sky* increase **your** interest in astronomy?

Not much	1	2	3	4	5	A great deal
----------	---	---	---	---	---	--------------

4b. How much did your visit to *My Sky* increase the interest in astronomy of **the children** you are with today?

Not much	1	2	3	4	5	A great deal
----------	---	---	---	---	---	--------------

5a. How much did **you** learn about astronomy from the *My Sky* exhibit?

Not much	1	2	3	4	5	A great deal
----------	---	---	---	---	---	--------------

5b. How much did **the children** you are here with today learn about astronomy from the *My Sky* exhibit?

Not much	1	2	3	4	5	A great deal
----------	---	---	---	---	---	--------------

5c. How much did the exhibit help **the children** you are with today practice science (watch closely, take a guess, test an idea, find a pattern use their imaginations)?

Not much	1	2	3	4	5	A great deal
----------	---	---	---	---	---	--------------

5d. How much did **you** learn about scientists, artists or other people who are inspired by the sky from the *My Sky* exhibit?

Not much	1	2	3	4	5	A great deal
----------	---	---	---	---	---	--------------

6. Did the exhibit have enough information to help you talk to the children you are with today about ideas in astronomy?

No, not enough	1	2	3	4	5	Yes, a great deal
----------------	---	---	---	---	---	-------------------

7. Now that you have visited the *My Sky* exhibit, how likely are you to try the following astronomy activities with the children you are with today?

a. Look up at the night sky

Not at all	1	2	3	4	5	Very likely
------------	---	---	---	---	---	-------------

b. Watch TV shows about astronomy

Not at all	1	2	3	4	5	Very likely
------------	---	---	---	---	---	-------------

c. Read books about astronomy

Not at all	1	2	3	4	5	Very likely
------------	---	---	---	---	---	-------------

d. Go to websites to learn new things about astronomy

Not at all	1	2	3	4	5	Very likely
------------	---	---	---	---	---	-------------

e. Play games or other hands on activities about astronomy

Not at all	1	2	3	4	5	Very likely
------------	---	---	---	---	---	-------------

8. Gender ____Female ____Male Zip Code _____

Ages of the children that accompanied you to *My*

Sky: _____

9. May the developers of this exhibit contact you to follow-up on your experience at the exhibit?

Yes: _____ email address: _____

No thanks: _____

Appendix E: Exit Interview Form for Stepping Stones Museum

Hi. We're working with the museum to get visitor feedback about the *My Sky* exhibit. Would you be willing to spend 5 minutes answering some questions?

Interview #_____ Date: Group Size:

Gender/Ages in group:

Group Composition (child is with: parents, grandparents, caregiver, other_____)

1. What is one thing that will you remember about your visit to *My Sky* today?

2. If you were to describe this exhibit to a friend, what would you say it was about?

3. Why do you think the people who made this exhibit named it *My Sky*?

4a. Did you learn anything new in the *My Sky* exhibit? If yes, What?

4b. (if adult) Do you think **the child/children** you are with today learned anything new in the *My Sky* exhibit? If so, what kinds of things?

5. (if adult) Do you think **the child/children** you are with today practiced science (watch closely, take a guess, test an idea, find a pattern use their imaginations) while in the exhibit? If yes, which skill?

There are five big areas of the exhibit. For each of these, how would you describe your experience?

6a. *Skate park* area of the exhibit where people can explore their shadows? (show pic.)

- 1) I did not visit this area of the exhibit
- 2) I stood on the skateboard and saw my own shadow
- 3) I worked together with someone else to explore shadows
- 4) I watched someone else in my group explore their shadow
- 5) Other, please describe _____

What do you remember most about shadows?

6b. *The Helioviewer* where people can see solar events like flares, eclipses and even solar tornadoes (show pic.)

- 1) I did not visit this area of the exhibit
- 2) I explored the solar movies on my own
- 3) I explored the solar movies with someone else in my group
- 4) I watched someone else in my group explore the solar movies
- 5) Other, please describe _____

Do you remember anything about how these movies of the sun were made?

6c. *The Big Moon* where people can touch craters, mountains and valleys of the moon? (show pic.)

- 1) I did not visit this area of the exhibit
- 2) I listened to the tour and explored different parts of the moon myself
- 3) I explored the moon with someone else in my group
- 4) I watched someone else in my group explore different parts of the moon
- 5) Other, please describe _____

What do you remember most about the moon?

6d. The *Backyard* area of the exhibit where people can sit by a campfire and watch stars move across the sky? (show pic.)

- 1) I did not visit this area of the exhibit
- 2) I watched the movie myself
- 3) I watched the movie with someone else in my group
- 4) I watched someone else in my group explore the different areas of the backyard
- 5) Other, please describe _____

What do you remember most about this area?

6e. The *Bedroom* area of the exhibit where people can create their own constellations and explore different phases of the moon?

- 1) I did not visit this area of the exhibit
- 2) I created a constellation or used the model of the earth moon and sun myself
- 3) I worked together with someone in my group to create a constellation or to explore the phases of the moon
- 4) I watched someone else in my group create a constellation or use the moon phase model
- 5) Other, please describe _____

What do you remember most about this area?

7. Did you notice any of the stories about scientists, artists or other people who are inspired by the sky? Which ones?

8. Did any of the activities in *My Sky* remind you of experiences you've had outside of the museum?

9. On a scale from 1-5, how likely are you to try the following astronomy activities at

home?

_____ Look up at the night sky

_____ Watch TV shows about astronomy

_____ Read books about astronomy

_____ Play games or other hands on activities about astronomy

_____ Go to websites to learn new things about astronomy (which sites would you explore first?)

10. (if adult) May we contact you to follow-up on your experience at the exhibit?

No: _____ Yes: _____

email address: _____

phone number: _____

Appendix F: Exit Interview Form for Providence Children's Museum

Hi. We're working with the developers of this exhibit to get visitor feedback about the *My Sky* exhibit. Would you be willing to spend 5 minutes answering some questions?

Interview # _____

Date:

Group Size:

Gender/Ages in group:

Group Composition (child is with: parents, grandparents, caregiver, other _____)

1. What is one thing that will you remember about your visit to *My Sky* today?

2. If you were to describe the *My Sky* exhibit to a friend, what would you say it was about?

3. Why do you think the people who made this exhibit named it *My Sky*?

- 4a. Did you learn anything new in the *My Sky* exhibit? If yes, What?

- 4b (if adult). Do you think the child you are with today learned anything new in the *My Sky* exhibit? If so, what kinds of things?

There are four big areas of the exhibit. For each of these, how would you describe your experience?

5a. *The Heliviewer* where people can see solar events like flares, eclipses and even solar tornadoes (show pic.)

- 1) I did not visit this area of the exhibit
- 2) I explored the solar movies on my own
- 3) I explored the solar movies with someone else in my group

- 4) I watched someone else in my group explore the solar movies
- 5) Other, please describe _____

Do you remember anything about how these movies of the sun were made?

5b. *The Big Dome* where people can participate in astronomy activities? (show pic.)

- 1) I did not visit this area of the exhibit
- 2) I participated in the activities myself
- 3) I participated in the activities with someone else in my group
- 4) I watched someone else in my group participate in the activities
- 5) Other, please describe _____

What do you remember most about the dome?

5c. *The Time Lapse exhibit* area of the exhibit where people can watch stars move across the sky? (show pic.)

- 1) I did not visit this area of the exhibit
- 2) I watched the movie myself
- 3) I watched the movie with someone else in my group
- 4) I watched someone else in my group watch the movie
- 5) Other, please describe _____

What do you remember most about this area?

5d. *The Bedroom* area of the exhibit where people can create their own constellations and explore different phases of the moon?

- 1) I did not visit this area of the exhibit
- 2) I created a constellation or used the model of the earth moon and sun myself
- 3) I worked together with someone in my group to create a constellation or to explore the phases of the moon
- 4) I watched someone else in my group create a constellation or use the moon phase model
- 5) Other, please describe _____

What do you remember most about this area?

6. Did you notice any of the stories about scientists, artists or other people who are inspired by the sky? Which ones?

7. Did any of the activities in *My Sky* remind you of experiences you've had outside of the museum?

8. On a scale from 1-5, how likely are you to try the following astronomy activities at home?

_____ Look up at the night sky

_____ Watch TV shows about astronomy

_____ Read books about astronomy

_____ Play games or other hands on activities about astronomy

_____ Go to websites to learn new things about astronomy (which sites would you explore first?)

9. May we contact you to follow-up on your experience at the exhibit?

Yes: _____ email address: _____ phone number:

No thanks: _____