Miami Science Museum

Hurricanes and Climate Change: Local Impacts and Global Systems

Summative Evaluation Report

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EXECUTIVE SUMMARY

The Miami Science Museum received a grant from NOAA to design and develop an interactive multiuser exhibit that allows visitors to explore the global dimensions and local impacts of climate change. The exhibit aimed to raise public understanding about the underlying science, the human causes, and the potential impacts of climate change by combining the attraction of a 4-foot spherical display with a user-controlled interface that lets visitors control the sphere and choose from a range of global and local content. In particular the exhibit focused on climate-related impacts on South Florida, including the dangers posed by rising sea level and the possibility of more intense hurricanes. The project design emphasized strategies for engaging diverse, multigenerational audiences through development of a bilingual interface that is fully bilingual and that is designed to promote social interaction.

The final version of the exhibit comprised the spherical display, 3 touch kiosks, and 4 additional flat display screens, providing opportunities for multiple visitors to interact with the exhibit simultaneously in ways that traded off control of the sphere and complemented the selected global content display with related local images and data (see Figure 1 below and Figure 2 for a picture of the exhibit labeled with these parts). Control of the sphere and the two flanking sphere info display screens trades off between the three kiosks. One kiosk at a time controls the sphere, with corresponding sphere content on the kiosk screen for the duration of the control period. The other two kiosk screens display related local content, mirrored to the two local display screens.

Figure 1 Diagram of Exhibit Components
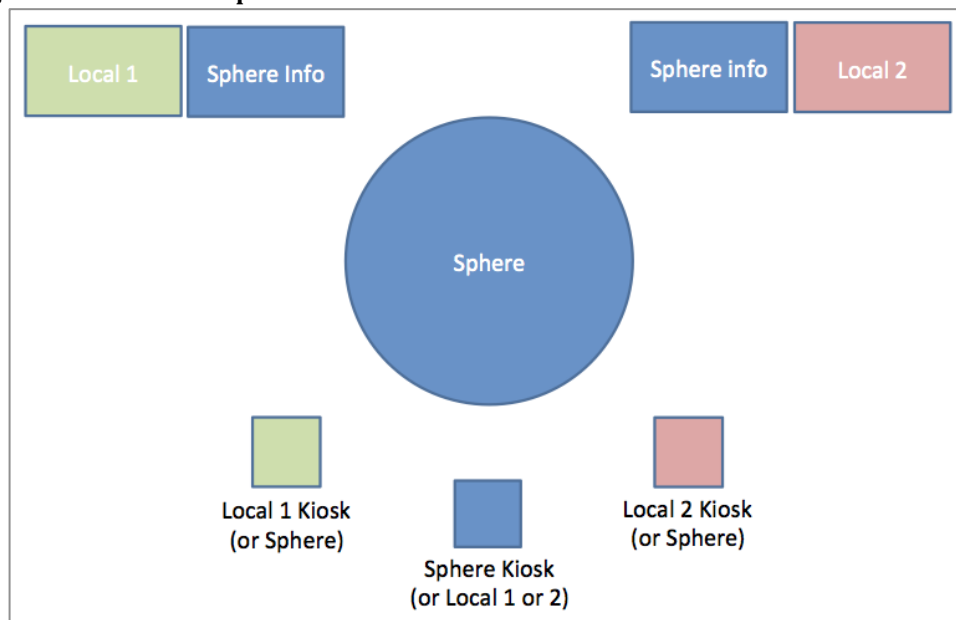
For the rest of the report, we use the following terms to refer to the above components:

Sphere = the three dimensional sphere/globe in the middle of the exhibit visually displaying various Earth systems, controlled by the touch screens

Touch screens = the three kiosk-based touch screens where visitors control what is showing on the sphere and what is showing on the two local content displays; a distinction is made between the two functions of the touch screens

- **Sphere kiosk** – the single touch screen controlling the sphere and sphere info displays

- **Local kiosk** – the two touch screens controlling the local content displays
Local content displays = content determined by the screen on the local kiosk
Sphere info displays =content determined by the sphere

The exhibit had four main goals:
1. Increase visitor awareness and understanding of Earth systems and the relationship between Earth systems, global weather and climate.
2. Increase visitor awareness of the role human activity plays in climate change.
3. Increase visitor awareness of the local effects of climate change.
4. Increase visitor concern about the reality of global warming and implications for their lives.

The purpose of the evaluation was to determine the extent to which the exhibit was meeting the goals outlined above, and to determine how visitors were reacting to and learning from the exhibit. Additionally, the study aimed to assess the effectiveness of the exhibit in engaging multigenerational bilingual visitors, and its effectiveness in promoting social interaction between and among groups, as well as the extent to which this may have improved learning outcomes.

METHODS AND CHARACTERISTICS OF THE SAMPLES

All data for this study were collected between September 21, 2012 and September 23, 2012. Audience Viewpoints developed instruments and procedures for this evaluation study in consultation with staff from the Miami Science Museum; see Appendix 1, Appendix 2, and Appendix 3. Data were collected by AVC staff on-site at the museum, and were coded and/or entered into statistical analysis software (SPSS, Version 19) or analyzed using qualitative methods. All evaluation materials were available in both Spanish and English, and were administered based upon the preference of the visitor group. Specific efforts were made to recruit Spanish-speaking groups, in order to determine how the bilingual nature of the exhibition was working for Spanish-speakers.

A total of 70 visitor groups participated in the study on-site at the museum, representing a total of 216 visitors. Of these groups, 59 groups chose to be interviewed in English and 11 groups chose to be interviewed in English. It should be noted that there were quite a few groups interviewed in English that spoke both English and Spanish when interacting with the exhibits.

Method	TOTAL Sample size (n= # of groups)
Observations + Interviews	n=70
- Interviews in English	n=59
- Interviews in Spanish	n=11

The following methods were used to collect data, and were conducted in the preferred language of the group (English/Spanish).

1. **OBSERVATIONS** - Observations of how visitors used the exhibit were recorded to gather detailed data about what groups were doing, including which screens they accessed, how they interacted with the exhibit and each other.

2. **INTERVIEWS WITH ENGLISH AND SPANISH SPEAKERS** - Interviews with English and Spanish speakers were used to gather more qualitative, open-ended feedback about the bilingual experience in the exhibition, as well as other exhibition-related outcomes. After the interview, visitors also filled

out a short survey that included demographics, as well as a short section of rating items that were easier for the respondent to fill out themselves than have an interviewer employ.

MAIN FINDINGS

This study focused on the five main areas listed below. More detail about these and other issues around the bilingual approach can be found in the body of the report.
1. Interactions with the sphere – how did groups use the exhibit, interact with each other, in which languages, and which screens did they focus on
2. Overall reactions to the exhibit – what did visitors like, what did they find interesting
3. Learning about Earth Systems – were visitors aware of the Earth Systems content
4. Learning about climate change – what did groups learn about climate change, and how did the exhibit change how they felt about climate change
5. Personal and local connections – what kinds of personal connections did visitors make, and what did they learn about local issues related to climate change

Interactions with the sphere
Median time spent engaged with the exhibit was 4 minutes, with time spent ranging from 59 seconds to 9 minutes. More than two-thirds of groups (70%) spent between 2 and 6 minutes. The exhibit did do a good job of engaging multigenerational groups, as the exhibit was engaging for nearly all groups: 99% of the groups read text, 97% spoke to each other while at the exhibit, and 88% interacted physically with the exhibit in some way. The majority of all visitor groups (72%) read the text in English, 12% read text in Spanish, and 16% read it in both languages. For Hispanic/Latino groups, about half (53%) read in English, 21% read in Spanish and 26% read in both English and Spanish.

Almost all of the groups (96%) actually controlled the sphere, though there was some confusion among the relationship between the Sphere Kiosk and Local Kiosks. Of those groups that were asked only 59% realized that the content on the Sphere Kiosk was determining the content on the Local Kiosks. The large majority of groups (88%) stayed in front of the exhibit, while 12% of groups had at least one person walk around to the other side of the exhibit. Meanwhile, people in 88% of the groups physically interacted with the exhibit, with more than half of the groups (57%) having more than one person in the group using the touch screens.

The touch screens were separated into three types: title screens, sphere kiosk screens and local kiosk screens. Among the touch screens, the sphere kiosk screens, 62% of all touch screens viewed, were the most common touch screens viewed. These were followed by the title screens, which were always accessed if the group was starting out with no one else at the exhibit; if someone else was there and controlling the sphere, they would start at the local kiosk screens. The local kiosk screens, meanwhile, accounted for 14% of all of the touch screens viewed. In terms of specific sphere kiosk or local kiosk screens, the five most popular were all sphere kiosk screens: Ocean Temperatures & Currents (9%), Population Growth (8%), Sea Level Rise (7%), Energy From the Sun (6%), and Strong Storms (6%).

Overall reactions to the exhibit
The general aspects of the exhibit visitors liked most were the information (61%), the sphere itself (59%) and the interaction (28%). The three most common specific reasons given were controlling the sphere (20%), the interactive experience (20%) and reading about interesting and current information (11%).

When visitors were asked what they found to be interesting about the exhibit, for meta-categories over half commented about the sphere (59%), followed by information (35%) and specific content (30%). In terms of specific things found interesting, visitors most frequently responded that the images projected on the sphere (22%), the ability to control the sphere (16%) and the interaction with the sphere (13%). Visitors also thought the exhibit was very informative (10%), and mentioned a wide variety of specific facts they had learned.

Learning from the exhibit in general
The most common meta-categories for what visitors learned were environmental information (24%), information about the ocean (16%), the local area (15%), human activity (15%) and climate change (12%). The most common specific answers were temperature change (9%), sea level rise (7%), fires (6%), the Miami population (6%), electricity (6%) and population (6%).

Almost half (47%) of the groups strongly agreed that they learned new things about how the Earth and its related system work. When asked which specific Earth Systems were covered in the exhibit, responses could be categorized into three main systems: the atmosphere (40%), hydrosphere (25%), and the biosphere (16%). More specifically, the most common categories mentioned were wind patterns (10%), climate or climate systems (9%), hurricanes (8%), and weather (7%).

Learning about climate change
In addition to wanting to know what visitors were learning in general, there was a particular interest in the extent to which visitors were learning about climate change. When asked the extent to which they learned new things about climate change and its impacts, almost half (48%) strongly agreed (6 or 7) and another 31% gave it a 4 or 5 rating; 12% strongly disagreed with a 1 or 2 rating. When asked specifically what they learned about climate change, about half of the groups said they didn't really learn anything new. However, more than one third (37%) mentioned learning about the relationship between climate change and weather, especially about temperature (13%) and global consequences (7%). Almost one in five (18%) mentioned humans and climate change, especially around pollution (7%) and humans affecting the Earth's climate (6%). Another 10% mentioned climate change and the ocean, with 7% of all respondents mentioning sea level rise.

Personal and local connection
More than half of the groups (52%) said they learned about how climate change directly affects them, and more than one third (36%) said they learned about how they impact climate change. Asked whether the exhibit changed how they felt about climate change, 36% said Yes and 64% said No. When asked why it did change how they felt, people said they gained information (24%) or an awareness (19%), or mentioned a concern about human action (14%).

Asked if as a result of the exhibit they better understood the relationship between climate change and local weather, 44% strongly agreed (6 or 7), another 35% rated it a 4 or 5, while 17% disagreed, with a 1 or 2 rating. When specifically asked if they saw examples of how climate change was affecting things locally, in Florida or Miami, half (50%) said they did. Asked to share specific examples, nearly half (45%) mentioned the ocean/sea level rise, hurricanes or storms (39%), or the local weather (16%). The two most common words or phrases, by far, were *hurricanes* and *sea level rise*. As a result of seeing the exhibit, half (51%) said they were more concerned about the impact of climate change on the local environment.

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INTRODUCTION

PROJECT BACKGROUND

 The Miami Science Museum received a grant from NOAA to design and develop an interactive multiuser exhibit that allows visitors to explore the global dimensions and local impacts of climate change. The exhibit aimed to raise public understanding about the underlying science, the human causes, and the potential impacts of climate change by combining the attraction of a 4-foot spherical display with a user-controlled interface that lets visitors control the sphere and choose from a range of global and local content. In particular the exhibit focused on climate-related impacts on South Florida, including the dangers posed by rising sea level and the possibility of more intense hurricanes. The project design emphasized strategies for engaging diverse, multigenerational audiences through development of a bilingual interface that is fully bilingual and that is designed to promote social interaction.

The final version of the exhibit comprised the spherical display, 3 touch kiosks, and 4 additional flat display screens, providing opportunities for multiple visitors to interact with the exhibit simultaneously in ways that traded off control of the sphere and complemented the selected global content display with related local images and data (see Figure 2 below and Figure 3 for a picture of the exhibit labeled with these parts). Control of the sphere and the two flanking sphere info display screens trades off between the three kiosks. One kiosk at a time controls the sphere, with corresponding sphere content on the kiosk screen for the duration of the control period. The other two kiosk screens display related local content, mirrored to the two local display screens.

Figure 2 Diagram of Exhibit Components
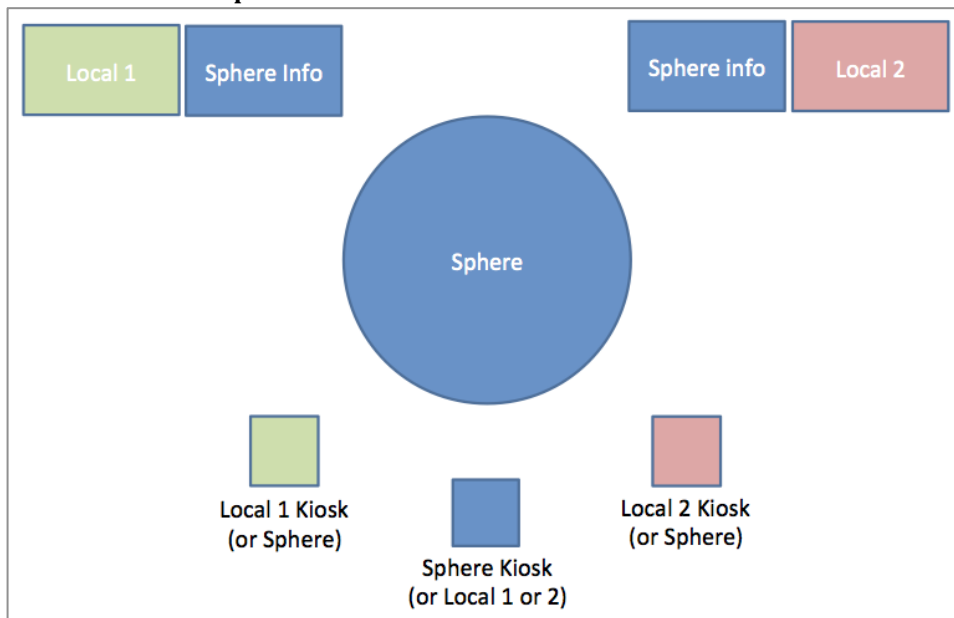
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EXHIBIT GOALS

The exhibit had four main goals:
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The purpose of the evaluation was to determine the extent to which the exhibit was meeting the goals outlined above, and to determine how visitors were reacting to and learning from the exhibit. Additionally, the study aimed to assess the effectiveness of the exhibit in engaging multigenerational bilingual visitors, and its effectiveness in promoting social interaction between and among groups, as well as the extent to which this may have improved learning outcomes.

EVALUATION FOCUS

Audience Viewpoints Consulting (AVC), an educational research and evaluation organization, was contracted by Miami Science Museum to conduct the summative evaluation for *Hurricanes and Climate Change* to examine the impact of bilingual interpretation in this permanent exhibit. The purpose of the evaluation was to determine the extent to which the exhibit was meeting the goals outlined above, and to determine how visitors were reacting to and learning from the exhibit.

The following report is organized into sections representing the key methods of the study: 1) **Observations of Exhibit Use 2) English- and Spanish-Language Surveys 3) English- and Spanish-Language Interviews**

METHODS

All data for this study were collected between September 21, 2012 and September 23, 2012. Audience Viewpoints developed instruments and procedures for this evaluation study in consultation with staff from the Miami Science Museum. Data were collected by AVC staff on-site at the museum, and were coded and/or entered into statistical analysis software (SPSS, Version 19) or analyzed using qualitative methods. All evaluation materials were available in both Spanish and English, and were administered based upon the preference of the visitor group. Specific efforts were made to recruit Spanish-speaking groups, in order to determine how the bilingual nature of the exhibition was working for Spanish-speakers.

A total of 70 visitor groups participated in the study on-site at the museum, representing a total of 216 visitors. Of these groups, 59 groups chose to be interviewed in English and 11 groups chose to be interviewed in English. It should be noted that there were quite a few groups interviewed in English that spoke both English and Spanish when interacting with the exhibits.

Table 1 summarizes the methods and samples from each method of the visitor study. A total of 70 visitor groups were included in the overall study.

Table 1 Summary of study methods and samples

Method	TOTAL Sample size (n= # of groups)
Observations + Interviews	n=70
- Interviews in English	n=59
- Interviews in Spanish	n=11

The following methods were used to collect data, and were conducted in the preferred language of the group (English/Spanish).

1. OBSERVATIONS

Observations of how visitors used the exhibit were recorded to gather detailed data about what groups were doing, including which touch screens they accessed, how they interacted with the exhibit and each other.

2. INTERVIEWS WITH ENGLISH AND SPANISH SPEAKERS

Interviews with English and Spanish speakers were used to gather more qualitative, open-ended feedback about the bilingual experience in the exhibition, as well as other exhibition-related outcomes. After the interview, visitors also filled out a short survey that included demographics, as well as a short section of rating items that were easier for the respondent to fill out themselves than have an interviewer employ.

LIMITATIONS OF THE STUDY

As with any study, in planning and carrying out the study there were limitations in what was possible. So that the reader may interpret the results in the proper context, below are reported a number of circumstances that likely affected the results of the study. The main areas identified as limitations in this particular study are who was eligible for the study, the sample size, and lack of a follow-up study.

- **Who was eligible for the study** – The study was conducted near the entrance to the MSM main exhibition floor. AVC staff (or affiliate contractor) went into the museum, or stood at the entrance to the main exhibition floor, to recruit participants. Recruitment aimed to maximize the number of individuals interviewed and surveyed. Thus participants in the study represent a convenient sample. The results may or may not be representative of MSM visitors overall, depending on whether there is any difference between visitors who elected to be part of the study and those who did not.

- **Sample sizes** – Given the budget available for the study, only a limited amount of data could be collected. While the sample size was adequate to perform analyses and yield the findings in this report, the sample size may not be big enough to include enough visitors and visitor types to be more representative of visitors in general. Therefore, if there are smaller effects or subtle differences they may not be detectable with a smaller sample size.

- **Lack of follow-up** – Since the data were collected on site right after experiencing the exhibit, it is possible that the findings in this report may fade over time, or may change in some manner. Without conducting a follow-up study, it is not possible to know whether the findings would persist and change over time. A follow-up study was attempted, but a smaller number of people providing their email address and a low response rate did not yield enough web survey respondents to allow for meaningful analysis.

The authors of this study do not believe that the limitations adversely impact or severely limit the current findings, and are included so that the reader of this report can understand the findings and results in the proper context.

CHARACTERISTICS OF THE SAMPLE

METHOD

Data collectors, both of whom were bilingual English/Spanish speakers, positioned themselves near the exhibit and waited for groups to pass through the room to intercept and ask them to participate in the study. However, during times where there were no visitors entering into the immediate area for a few minutes, data collectors went into other parts of the museum to recruit participants. While only one group was recruited at a time so that they could interact with and control the sphere, there were a few instances when a non-participating group was already at the exhibit when the recruited group engaged the exhibit.

When a group did agree to participate, they were shown the exhibit, asked to interact with it as they normally would (no longer or shorter) and asked to tell the data collector when they were done. When they were done, the group was interviewed (in English or Spanish, their choice), and then filled out a short survey in the same language they were interviewed in. See Appendices 1 to 3 for the data collection instruments: the Observation Sheet, and Interviews/Surveys in English and Spanish.

SAMPLE CHARACTERISTICS

A total of 70 groups participated between September 21, 2012 and September 23, 2012. Of the 70 groups, 59 were interviewed in English and 11 were interviewed in Spanish.

As summarized in Table 2, the largest age group consisted of visitors between the ages of 25 and 34 (38%), followed by those between 35 and 44 (26%) and 18 and 24 (20%). More than three-quarters (77%) were between the ages of 25 and 54. When considering the makeup of the groups, more than half (56%) visited the Museum with kid(s) under the age of 18, while 44% were adult-only groups. Groups with two adults with kid(s) (40%) or two adults no kids (28%) made up two-thirds (68%) of the groups included in the study. Almost two out of three groups (66%) had two or three people in it.

The majority of the visitors self-identified as Caucasian (88%)[1], while 12% cited a different ethnicity than Caucasian. 58% of participants indicated being of Hispanic, Latino or Spanish origin, while 42% of

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[1] The U.S. Census includes Hispanic/Latino in the "Caucasian" category, so this 88% does include Hispanic and Latino visitors.

participants did not. Visitors of Cuban heritage (17%) were the largest group of Hispanic/Latino origin, followed by those of South American (14%), and Puerto Rican heritage (8%). 70% of visitors preferred exhibits to be in English only, 2% preferred Spanish only, while 24% preferred both English and Spanish.

Table 2 Sample Characteristics

	Groups (n=70)	
	Frequency [2]	Percent
Age of Respondent	**66**	
Under 18	1	1%
18 to 24	13	20%
25 to 34	25	38%
35 to 44	17	26%
45 to 54	9	14%
55 to 64	0	0%
65 and older	1	1%
Number in Group	**68**	
1	2	3%
2	25	36%
3	21	30%
4	11	16%
5	4	6%
6	2	3%
7	2	3%
8	0	0%
9	1	1%
Group Type	**68**	
Single adult	4	6%
Two adults	19	28%
Three or more adults	7	10%
Single adult, with kid(s)	7	10%
Two adults, with kid(s)	27	40%
Three or more adults, with kid(s)	4	6%
Hispanic Origin	**66**	
Not of Hispanic Origin	28	42%
Cuban	11	17%
South American	9	14%
Puerto Rican	5	8%
Spanish Caribbean	4	6%
Mexican, Mexican American, Chicano	3	5%
Multiple Hispanic Origins	3	5%
Central American	2	3%
Other Hispanic, Latino,	1	1%

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[2] Not all participants filled out each of the survey items, so the sample size for each item vary to some degree.

Spanish		
Race/Ethnicity	**67**	
Caucasian	59	88%
Black/African American	5	8%
Multi-racial/Multi-ethnic	2	3%
Other Pacific Islander	1	1%
Language Preference for Exhibits	**67**	
English	47	70%
Spanish	2	3%
English & Spanish	16	24%
English & Another Language	2	3%

Table 3   **Language Preferences** for Exhibit, by Language *

Categories	Hispanic/ Latino Origin (n=37)		Non-Hispanic/Latino Origin (n=28)		Total (n=65)	
	Freq.	Pcnt.	Freq.	Pcnt.	Freq.	Pcnt.
Language Preference for Exhibits						
English	19	51%	26	93%	45	69%
Spanish	2	5%	0	0%	2	3%
English & Spanish	16	43%	0	0%	16	25%
English & Another Language	0	0%	2	7%	2	3%

* There was a statistically significant difference for language preference between Hispanic/Latino visitors and non-Hispanic/Latino visitors.

FINDINGS

Visitor Behavior (Observations)

In order to understand how groups used the exhibit, the data collector used an observation sheet to record which screens they were using, and some specific behaviors (see Appendix 1 for the Observation Sheet). Table 4 shows the frequency of these behaviors. Since the exhibit text was bilingual, evaluators recorded reading and speaking in English and Spanish.

Interactions Based on Language

In terms of which languages groups read the text in, it generally followed the self-reported preferences: 72% read the text in English, 12% read it in Spanish, and 16% read it in both languages (Table 4). These were also similar to the languages spoken: 79% of groups spoke to each other in English, 12% in Spanish and 7% in both languages. As expected, Hispanic/Latino were much more likely to read and

speak in Spanish (see Table 5). However, this did not mean that they always read text or spoke to each other in Spanish when interacting with the exhibit. In fact, about half (53%) of Hispanic/Latinos read only in English, 21% read in Spanish, and 26% read in both English and Spanish. In terms of speaking to each other, almost two-thirds (65%) of Hispanic/Latinos spoke to each other in English, while 13% spoke in Spanish and 2% spoke in both languages. This showed that Hispanic/Latino groups, even if they speak Spanish, do not always engage bilingual exhibits the same way; some engage the bilingual components while some do not.

Table 4 Bilingual Interactions and the Exhibit

Categories	Groups (n=70)	
	Frequency	Percent
Read Text	**69**	
In English	50	72%
In Spanish	8	12%
Both	11	16%
Language Spoken	**68**	
In English	54	79%
In Spanish	8	12%
Both	5	7%
Other	1	1%

Table 5 Bilingual Interactions, by Ethnicity

Categories	Hispanic/Latino Origin (n=38)		Non-Hispanic/Latino Origin (n=27)		Total (n=65)	
	Frequency	Percent	Frequency	Percent	Frequency	Percent
Read Text Languages						
English	20	53%	26	96%	46	71%
Spanish	8	21%	0	0%	8	12%
Both	10	26%	1	4%	11	17%
Language Spoken						
English	24	65%	26	96%	50	78%
Spanish	8	13%	0	0%	8	12%
Both	5	2%	0	0%	5	8%
Other	0	0%	1	4%	1	2%

Interactions with the Sphere

Almost all of the groups (96%) controlled the sphere, though of those groups that were asked only 59% realized that which screen the sphere was on determined the content options displayed on the local kiosk screens. The large majority of groups (88%) stayed in front of the exhibit, while 12% of groups had at least one person walk around to the other side of the exhibit. Meanwhile, people in 88% of the groups physically interacted with the exhibit, with more than half of the groups (57%) having more than one person in the group physically interacting with the exhibit.

Table 6 Interactions with the Sphere

Categories	Frequency	Percent
Group Controlled Sphere	**68**	
Yes	65	96%
No	3	4%

Realized Sphere Controlled Screens		**58**	
	Yes	34	59%
	No	24	41%
Number People Walked Around Exhibit		**68**	
	0	60	88%
	1	1	1%
	2	5	7%
	3	1	1%
	4	1	1%
Number of People Interacting		**68**	
	0	8	12%
	1	5	7%
	2	39	57%
	3	12	18%
	4	1	1%
	5	2	3%
	8	1	1%

Time Engaged with the Exhibit

The median time spent engaged with the exhibit was four minutes, with time spent ranging from 59 seconds to 9 minutes (see Table 7). More than two-thirds of groups (70%) spent between 2 and 6 minutes. While groups without kids (4 min 45 sec) spent a longer amount of time at the exhibit than those with kids (3 min 50 sec), no statistical difference was found between the groups for time at exhibit (see Table 8). However, even though groups that had control of the sphere (4 min 19 sec) spent approximately 2 more minutes engaged with the exhibit, than groups that did not control the sphere (2 min 25 sec) this was not a statistically significant difference.

Table 7 Time Spent at the Exhibit

Time Categories	Groups (n=66)	
	Frequency	Percent
0 to 1 minute	1	2%
1 to 2 minutes	6	9%
2 to 3 minutes	11	17%
3 to 4 minutes	17	26%
4 to 5 minutes	10	15%
5 to 6 minutes	8	12%
6 to 7 minutes	1	2%
7 to 8 minutes	8	12%
8 or more minutes	4	6%

Mean	4 min 50 sec	
Median	4 minutes	
Std. Deviation	2 min 4 sec	
Minimum	59 seconds	
Maximum	9 minutes	

Table 8 Summary of Time Spent at the Exhibit, by Group Type and Controlling Sphere

Categories	Groups (n=70)		
	Mean Time	Frequency	Percent
With Kids			
Groups with Kids	3min 50 sec	36	57%
Groups without Kids	4 min 45 sec	27	43%
Control of Sphere			
Group Controlled Sphere	4 min 19 sec	61	94%
Group did not Control Sphere	2 min 25 sec	3	6%

Types of Screens Engaged With

There were four main components in the exhibit: 1) the three-dimensional Sphere, 2) three Touch Screens (one Sphere Kiosk and two Local Kiosks), 3) the Local Content Displays, and 4) Sphere Info Displays (see Figure 3 below). The Sphere Kiosk touch screen was manipulated by visitors and determined what was on the Sphere and the Sphere Info Displays, by picking from the main screens off of the title page. While one person was controlling the Sphere, the other two Local Kiosk touch screens controlled what was on the Local Content Displays. In this manner, three different individuals or groups could control which content they were seeing. However, to prevent one group from monopolizing control of the Sphere, people on the local kiosk touch screens could request control of the Sphere by pressing a button. After the request, a certain time would elapse and then control of the Sphere was transferred to them. This time was counted down on the both the sphere kiosk and the local kiosks. As a result of this process, the Sphere Kiosk could be on any of the three touch screens and could be transferred from one to the other. See Appendix 1 for pictures of the main Sphere Kiosk and Local Kiosk screens.

Figure 3 *Hurricanes and Climate Change* **Exhibit Components**
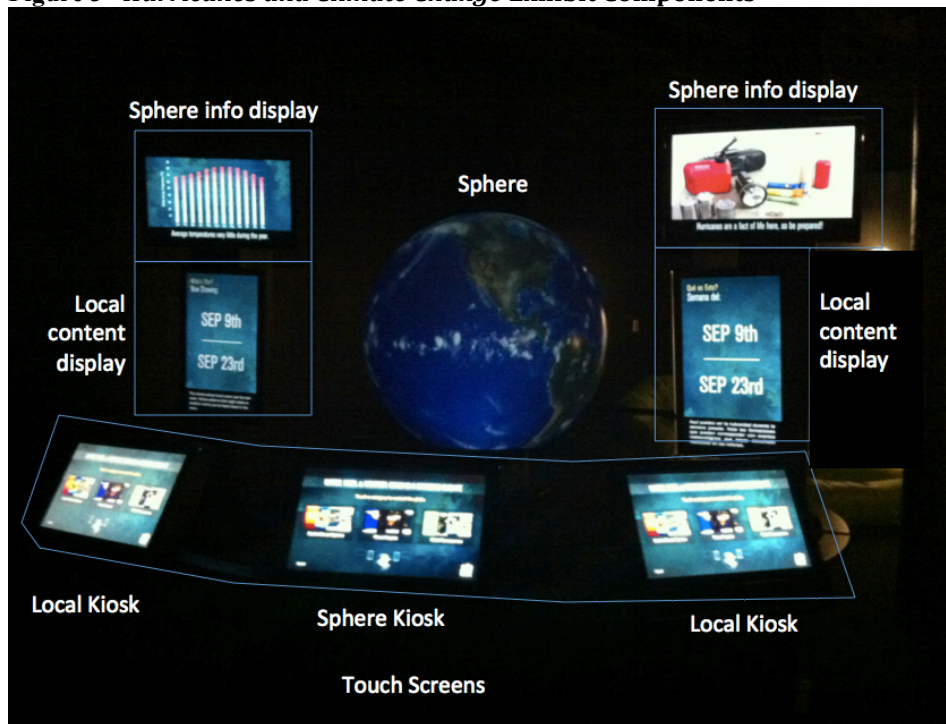
The evaluation recorded which types of touch screens visitors engaged in, since these were interactive and it was possible to see which specific screen they were selecting: Title Screens, Sphere Kiosk Screens and Local Kiosk Screens. Appendix 1 shows the 4 Title Screens, the 12 Sphere Kiosk Screens and the 12 Local Kiosk Screens; there is additional layer of content visitors can access for each of the Local kiosk screens shown in the Appendix 1, but these were not included in the evaluation.

Tables 9 and 10 summarize the general and specific screens viewed by visitor groups. The Sphere Kiosk Screens, at 62% of all screens viewed, were the most common screens viewed. These were followed by the Title Screens, which were always accessed if the group was starting out with no one else at the exhibit; if someone else was there and controlling the sphere, then they would start at the Local Kiosk Screens. The Local Kiosk Screens, meanwhile, accounted for 14% of all of the screens viewed. In terms of specific Sphere or Local Kiosk Screens, the five most popular were all Sphere Kiosk Screens: Ocean Temperatures & Currents (9%), Population Growth (8%), Sea Level Rise (7%), Energy From the Sun (6%), and Strong Storms (6%).

Table 9   Summary of Touch Screens Viewed

Categories	Groups (n=66)	
Type of Touch Screen Viewed	Frequency	Percent
Title Screen (4 possible screens)	61	25%
Sphere Kiosk Screen (12 possible screens)	154	62%
Local Kiosk Screen (12 possible screens + additional content)	34	52%
Stopped	15	14%

Table 10 Summary of Specific Touch Screens Viewed

Categories	Groups (n=66) Total Screen Views[3] = 249	
	Frequency	Percent
Title Screen (4 possible screens)	**61**	**25%**
Sphere Kiosk Screens (12 possible screens)	**154**	**62%**
Energy From the Sun	16	6%
Ocean Temperature & Currents	23	9%
Wind Patterns	11	4%
Current Weather	9	4%
Population Growth	20	8%
Electricity Use	12	5%
Transportation	4	2%
Global Fires	9	4%
Temperature Changes	6	2%
Sea Level Rise	18	7%
Ocean Acidification	12	5%
Strong Storms	16	6%
Local Kiosk Screens (12 possible screens)	**34**	**14%**
Energy from the Sun	4	2%
Ocean Temperature & Currents	6	2%
Wind Patterns	3	1%
Current Weather	3	1%
Population Growth	0	0%
Electricity Use	3	1%
Transportation	0	0%
Global Fires	1	<1%
Temperature Changes	1	<1%
Sea Level Rise	3	1%
Ocean Acidification	2	<1%
Strong Storms	6	2%

Appendix 4 shows the pathways of the first 4 screens viewed by the visitors in the study.

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[3] While we record "screens" for the Local Kiosk Screens as the "Parent" level, there are multiple screens available beneath the Local Kiosk Screens listed

Reaction and Impact of Exhibit (Interviews / Surveys)

The following findings result from the interview and survey conducted with groups, showing what visitors thought about the exhibit. Topics include general reactions to the exhibit, what visitor learned, how the exhibit affected their thinking about climate change. See Appendix 2 for the instrument in English and Appendix 3 for the instrument in Spanish.

What Visitors Liked Most

After visitors had engaged with the exhibit, they were asked what they had liked (see Table 11). The general aspects of the exhibit visitors liked most were the information (61%), the sphere itself (59%) and the interaction (28%). The three most common specific reasons given were controlling the sphere (20%), the interactive experience (20%) and reading about interesting and current information (11%). In addition to sharing what they liked, 33% of visitors also shared general negative comments or suggestions for improving the exhibit; the majority of these suggestions were about their perceived shortcomings of the exhibit and suggestions for modifications.

Table 11 What Visitors Liked About the Exhibit, Interviews

Categories	Groups (n=69)	
	Frequency	Percent
Information	**42**	**61%**
Information interesting, current	8	12%
"The information"	4	6%
Local information	4	6%
Environmental/Global consequences	3	4%
Change over time	3	4%
Lots of information	2	3%
Electricity	2	3%
Temperature	2	3%
Coral	2	3%
Climate change	1	1%
Miscellaneous Information	11	16%
Sphere	**41**	**59%**
Controlling the sphere	14	20%
Visual aspect & screens	6	9%
Seeing patterns & changes	5	7%
Pictures & images	5	7%
Just the sphere	4	6%
Miscellaneous Sphere	7	10%

General Negative Comments / Suggestions	23	33%
Exhibit better with modifications	9	13%
Exhibit not for kids	4	6%
Exhibit too fast	4	6%
Problems with exhibit function	3	4%
Exhibit difficult to understand	1	1%
Miscellaneous Negative Comments	2	3%
Interaction	**19**	**28%**
Interactive	14	20%
Ability to explore and choose	3	4%
Variety of things to do	2	3%
General Positive Comments	**6**	**9%**
Miscellaneous	**2**	**3%**

NOTE: Many groups gave more than one answer, so percentages total more than 100%.

What Visitors Found Most Interesting

When visitors were asked what they found to be interesting about the exhibit, for meta-categories over half commented about the sphere (59%), followed by information (35%) and specific content (30%). In terms of specific things found interesting, visitors most frequently responded that the images projected on the sphere (22%), the ability to control the sphere (16%) and the interaction with the sphere (13%). Visitors also thought the exhibit was very informative (10%), and mentioned a wide variety of specific facts they had learned.

Table 12 What Visitors Found Most Interesting About the Exhibit, Interviews

Categories	n=69	
	Frequency	Percent
Sphere	**41**	**59%**
Image	15	22%
Controlling the sphere	11	16%
Interaction	9	13%
Information feels real	2	3%
Sphere miscellaneous	4	6%
Information	**24**	**35%**
Information/Informative	7	10%
Ability to choose content	3	4%
Amount information available	2	3%

Human impacts on the environment	7	10%
Information miscellaneous	5	7%
Specific Content	**21**	**30%**
Electricity	3	4%
Population growth	2	3%
Florida/Miami	1	1%
Content miscellaneous	15	22%
General Negative	**8**	**12%**
Exhibit better with modification	2	3%
Too fast	1	1%
Takes too much time	1	1%
Not for kids	1	1%
Negative comments miscellaneous	3	4%
General Positive	**7**	**10%**
Praise	7	10%
Miscellaneous	**5**	**7%**
Nothing/Don't know	2	3%
Miscellaneous, miscellaneous	3	4%

NOTE: Some respondents gave more than one answer, so percentages total more than 100%.

What Visitors Learned from the Exhibit

To understand what visitors' may have learned through the exhibit, groups were asked to complete the following sentence: *"I never realized that...."* (see Table 13). In terms of the kinds of general topics groups mentioned, there were a wide variety of topics mentioned, and the most common meta-categories were environmental information (24%), information about the ocean (16%), the local area (15%), human activity (15%) and climate change (12%). As for the most common specific answers, they were temperature change (9%), sea level rise (7%), fires (6%), the Miami population (6%), electricity (6%) and population (6%).

The responses to the open-ended question *"I never realized that..."* were put into a word cloud (see Table 14), and in the word cloud you can also see the wide variety of topics that groups were learning about. The most common specific terms, shown as the largest text in the word cloud, were *electricity, fires, hurricanes, climate change, temperature, population growth* and *global consequences*. It seems like the main messages of the exhibit were coming through, in a variety of ways.

Table 13 New Information Learned

Categories	Groups (n=67)	
	Frequency	Percent
Environmental Information	**16**	**24%**
Temperature change-general	6	9%
Fires	4	6%
Hurricanes & storms	2	3%
Sun	1	1%
Environmental information miscellaneous	3	4%
The Ocean	**11**	**16%**
Sea level rise	5	7%
Affect on coral	2	3%
Ocean acidity	1	1%
Ocean miscellaneous	3	4%
Local Area	**10**	**15%**
Miami Population	4	6%
Local area miscellaneous	3	4%
Hurricanes & storms in Florida/Miami	2	3%
Florida and sea level rise	1	1%
Human Activity	**10**	**15%**
Electricity	4	6%
Population	4	6%
Airplanes	2	3%
Human activity miscellaneous	4	6%
Climate Change	**8**	**12%**
Global temperature & weather changes	3	4%
Global consequences	3	4%
Climate change	1	1%
Human Impact	**6**	**9%**
Consumption/Energy usage	3	4%
Carbon dioxide	1	1%
Pollution	1	1%
Human impact miscellaneous	1	1%
Prior Knowledge	**5**	**7%**
Knew about climate change	4	6%
Knowledge about climate change from media	1	1%

Nothing/Don't know	9	13%
Nothing/Don't know/No	9	13%
Climate change miscellaneous	1	1%
Miscellaneous	**11**	**16%**
Comments about exhibit	8	12%
Praise	2	3%
Miscellaneous, miscellaneous	1	1%

NOTE: Many respondents gave more than one answer, so percentages total more than 100%.

Figure 4 World Cloud[4] for words and phrases used to describe visitor responses to completing the sentence," I never realized that…",

Awareness of Earth Systems Covered

Groups were asked which of the Earth's systems they remember the exhibit talking about (see Table 14). Responses could be categorized into three main systems: the atmosphere (40%), hydrosphere (25%), and the biosphere (16%). The most specific categories mentioned were wind patterns (10%), climate or climate systems (9%), hurricanes (8%), and weather (7%). As can be seen from the word cloud (see Figure 5), the most common terms used were *climate, temperature, weather, hurricanes, population* and *wind.* When asked about whether visitors thought they had learned new things about how the Earth and related systems work, nearly half (47%) strongly agreed, giving a 6 or 7 on a 7-point scale (see Figure 11).

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[4] World Cloud was created using the website www.wordle.net

Table 14 Earth Systems Recalled By Visitors

Categories	Responses (n=131)	
	Frequency	Percent
Atmosphere	**52**	**40%**
Wind patterns	13	10%
Climate/Climate systems	12	9%
Weather	9	7%
Temperature	8	6%
Climate change	5	4%
Sun	4	3%
Atmosphere	1	<1%
Hydrosphere	**33**	**25%**
Hurricanes & Storms	10	8%
Sea level rise	8	6%
Water	5	4%
Ocean currents	4	3%
Ocean acidification	3	2%
Ocean temperatures	2	2%
Cryosphere	1	<1%
Biosphere	**21**	**16%**
Population	7	5%
Human Impacts	6	5%
Electricity	3	2%
Fire	3	2%
Coral	1	<1%
Transportation	1	<1%
Lithosphere	**1**	**<1%**
Miscellaneous	**24**	**18%**
Nothing/Don't know	13	10%
Miscellaneous	9	13%
Global consequences	2	2%

NOTE: Some respondents gave more than one answer, so percentages total more than 100%.

Figure 5 World Cloud[5] for words and phrases used to describe visitor responses to remembering Earth systems, Interview

Figure 6   Climate Change Questions, Survey

Learned New Things About How the Earth and Related Systems Work

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[5] World Cloud was created using the website www.wordle.net

Perceptions of Climate Change

Visitor groups were asked to rate their agreement with a series of statements about human impacts and climate change, ranging from 1 (strongly disagree) to 7 (strongly agree) (see Figures 7 to 8). When asked to what extent they thought climate change was real, 70% rated it a 7 on a 7-point scale; on the other end 13% rated it 1 or 2, strongly disagreeing that it was real (see Figure 5). There was somewhat less agreement about whether humans caused climate change: while 58% strongly agreed (6 or 7 rating), another 23% rated it a 4 or a 5, and 15% strongly disagreed, giving it a 1 or 2 rating (see Figure 6).

Figure 7   Perceptions about Reality of Climate Change

Climate Change Is Real
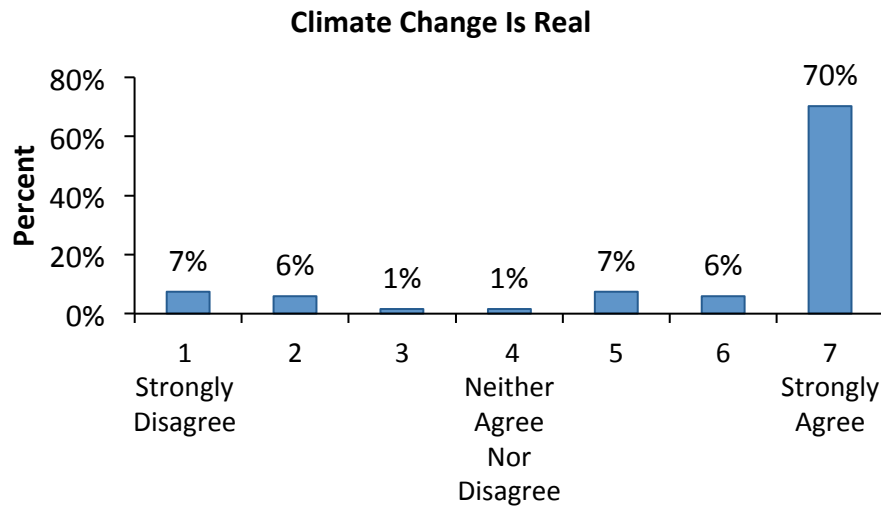
Figure 8   Climate Change Caused by Human Activity

Climate Change Is Caused By Human Activity
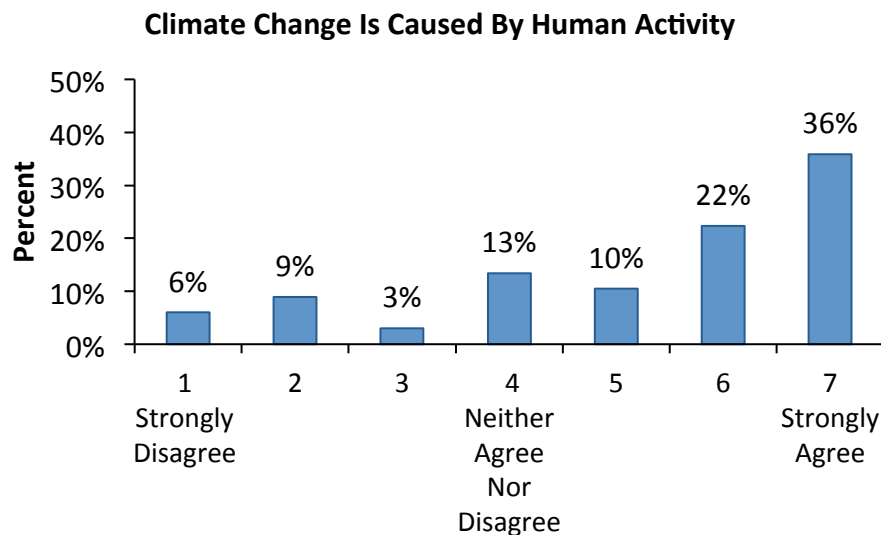
Learning about Climate Change

Another rating item asked about the extent to which visitors learned new things about climate change (see Figure 9). Nearly half (48%) strongly agreed that they learned something new about climate change from the exhibit, giving it a 6 or 7 on a 7-point scale. As a follow-up question to the rating, visitors were also asked an open-ended question about what they specifically learned about climate change from the exhibit (see Figure 10 and Table 15). Figure 10 shows a word cloud in response to the open-ended item, while Table 15 shows those responses coded into categories. In contrast to the rating question, almost half of the groups (45%) said they either didn't learn anything new about climate change or couldn't come up with a specific response. More than one third (37%) mentioned learning about the relationship between climate change and weather, especially about temperature (13%) and global consequences (7%). Almost one in five (18%) mentioned learning about humans and climate change, especially the topics of pollution (7%) and humans affecting the Earth's climate (6%). Another 10% mentioned climate change and the ocean, with 7% of all respondents mentioning sea level rise.

This difference between the high proportion of visitors reporting learning new things about climate change then one third of all respondents not being able to come up with a specific example, could have occurred for a couple of reasons. First, it is possible that people were simply over-confident in their ratings of how much they learned about climate change, so when it came time to recall examples they simply couldn't come up with them; it may be easier to say you learned new things than recall examples. Secondly, it is possible that they did learn new things about climate change, but that in an interview situation they did not have sufficient time to think about and respond to the item. That is, they had a sense that they learned something specific, but couldn't recall or articulate the specific examples at the time. As Table 15 shows, given that many visitors gave multiple responses to the question of what they learned, it is also possible that for those who said they learned nothing about climate change, they may not have made the connection between the specific content they investigated and the over-arching message about climate change, even though they may have learned new things about Earth systems, temperature increases, local changes, etc. Since there was no requirement for any visitor to systematically explore all of the content, they may not have interacted with enough of the content to make this connection.

Figure 9 **Learning New Things About Climate Change**

Learned New Things About Climate Change and Its Impacts
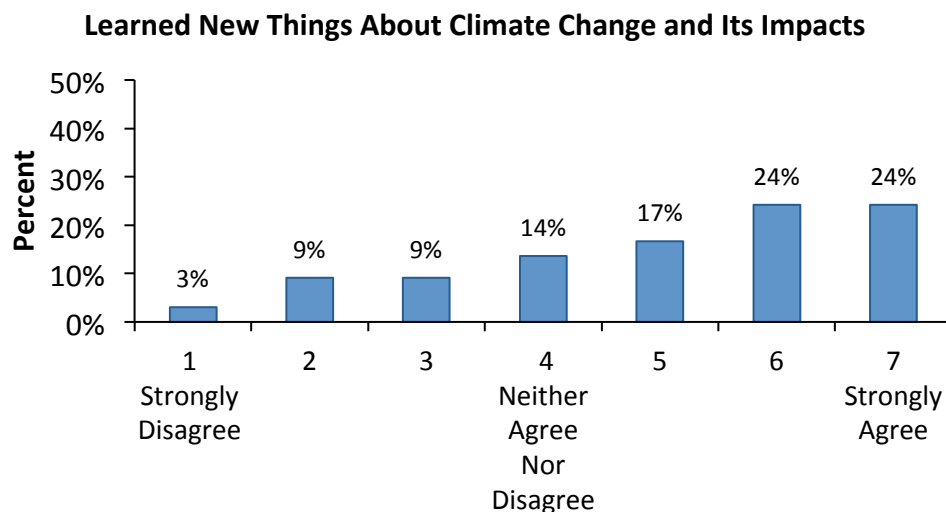
Figure 10 World Cloud[6] for words and phrases used to describe visitor responses to learning about climate change from the exhibit, Interview

Table 15 What Visitors Learned About Climate Change

Categories	Groups (n=67)	
	Frequency	Percent
Did Not Learn About Climate Change	**30**	**45%**
Did not learn about climate change	18	18%
Don't know	10	10%
Didn't look at climate change	2	2%
Climate & Weather Changes	**25**	**37%**
Temperature	9	13%
Global consequences	5	7%
Climate & weather changes miscellaneous	4	6%
Climate change varies	3	4%
Climate change has happened	2	3%
Wind	1	1%
Changes in Florida/Miami	1	1%
Human Activity Related to Climate Change	**12**	**18%**
Pollution/Emissions	5	7%
Humans have affected the Earth's climate	4	6%
Population	1	1%
Human activity miscellaneous	2	3%
Prior Knowledge	**11**	**16%**
Knew about climate change	8	12%
Climate change debatable	1	1%
Prior knowledge miscellaneous	2	3%
Ocean	**10**	**15%**

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[6] World Cloud was created using the website www.wordle.net

Sea level rise	5	7%
Coral	1	1%
Ocean temperature	1	1%
Ocean miscellaneous	3	4%
Miscellaneous	**10**	**15%**
Problems with the exhibit	4	6%
Miscellaneous, miscellaneous	6	9%

NOTE: Some respondents gave more than one answer, so percentages total more than 100%.

Climate Change, Personal Connections and Local Issues

On a more personal note, more than half of the groups (52%) said they learned about how climate change directly affects them, and more than one third (36%) said they learned about how they impact climate change (see Figures 9 and 10, respectively). Asked whether the exhibit changed how they felt about climate change, 36% said Yes and 64% said No. When asked why it did change how they felt, people said they gained information (24%) or an awareness (19%), or mentioned a concern about human action (14%) (see Table 16). For those who it didn't change their feelings, it was because they felt they were already knowledgeable or concerned about climate change (32%), they didn't learn anything new (22%), or didn't change their feelings (12%).

Asked if as a result of the exhibit they better understood the relationship between climate change and local weather, 44% strongly agreed (6 or 7), another 35% rated it a 4 or 5, while 17% disagreed, with a 1 or 2 rating (see Figure 11). When specifically asked if they saw examples of how climate change was affecting things locally, in Florida or Miami, half (50%) said they did. Asked to share specific examples, nearly half (45%) mentioned the ocean/sea level rise, hurricanes or storms (39%), or the local weather (16%). The two most common words or phrases, by far, were *hurricanes* and *sea level rise* (see Figure 12). As a result of seeing the exhibit, half (51%) said they were more concerned about the impact of climate change on the local environment (see Figure 12).

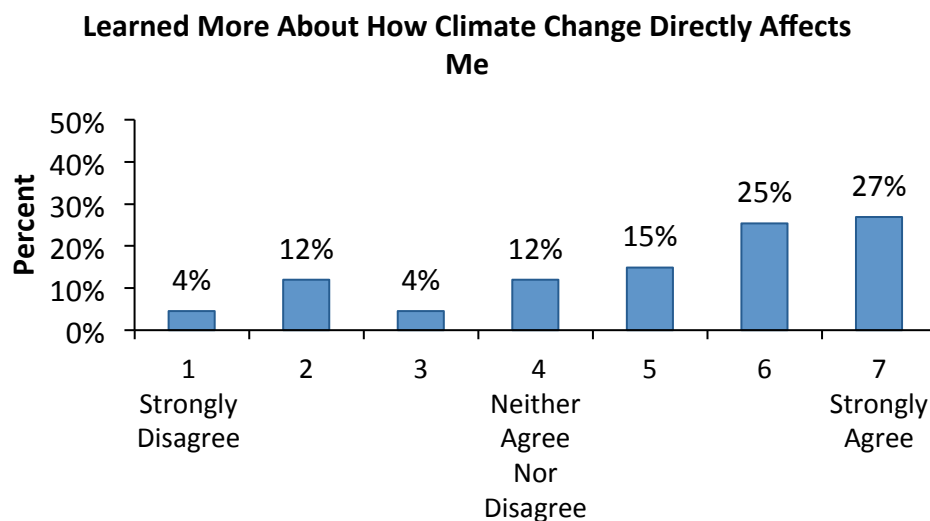**Figure 11 Climate Change Affecting Visitors**
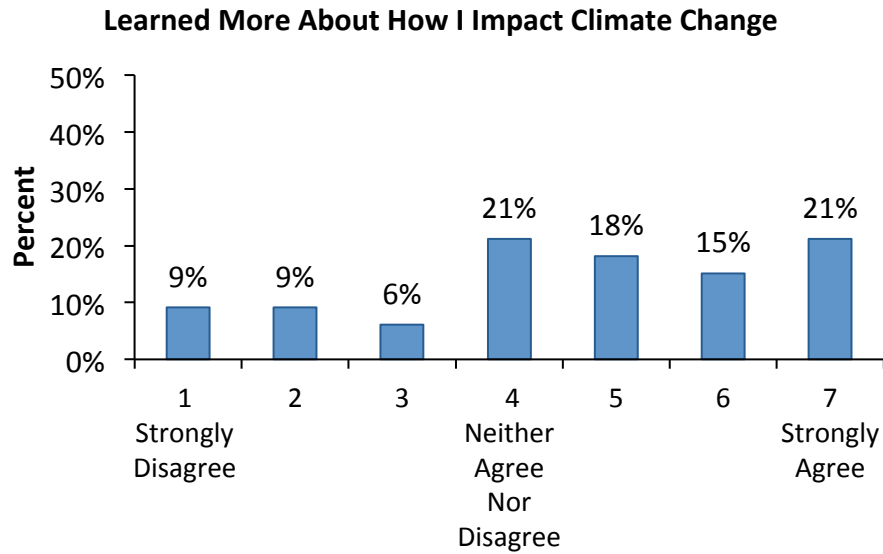

Learned More About How Climate Change Directly Affects Me

Figure 12 Visitors Affecting Climate Change

Learned More About How I Impact Climate Change

Table 16 Change Feelings About Climate Change, Why or Why Not

Categories	Groups (n=59)	
	Frequency	Percent
Prior Knowledge	**19**	**32%**
Knew about climate change	13	22%
Concerned about climate change	5	8%
Knowledge miscellaneous	1	2%
Gained Information	**14**	**24%**
Now know more about climate change	4	7%
Saw examples of climate change	4	7%
Exhibit visualized global changes	3	5%
Exhibit explained climate change	2	3%
Information miscellaneous	1	2%
Did Not Learn About Climate Change	**13**	**22%**
Not enough time to learn about climate change	6	10%
Don't know	5	8%
Didn't read about climate change	1	2%
Did not learn miscellaneous	1	2%
Gained Awareness	**11**	**19%**
More aware	2	3%
More interested/curious	2	3%
Climate change is a global issue	2	3%
A reminder of climate change	2	3%
Changed perspective	2	3%
Interesting to know about climate change	1	2%

Awareness miscellaneous	0	0%
Concern About Human Action	**8**	**14%**
Human role in climate change or environment	4	7%
Humans need to be concerned or understand	2	3%
Human action miscellaneous	2	3%
No Feeling or Change of Feeling	**7**	**12%**
No personal connection or feelings about climate change	4	7%
Felt the same before and after	2	3%
Feelings miscellaneous	1	2%
Miscellaneous	**5**	**8%**
General praise	2	3%
General negative	1	2%
Comments about the sphere	1	2%
Miscellaneous, miscellaneous	1	2%

NOTE: Some respondents gave more than one answer, so percentages total more than 100%.

Figure 13 Understanding Relationship Between Climate Change and Local Weather

Better Understand the Relationship Between Climate Change and Local Weather
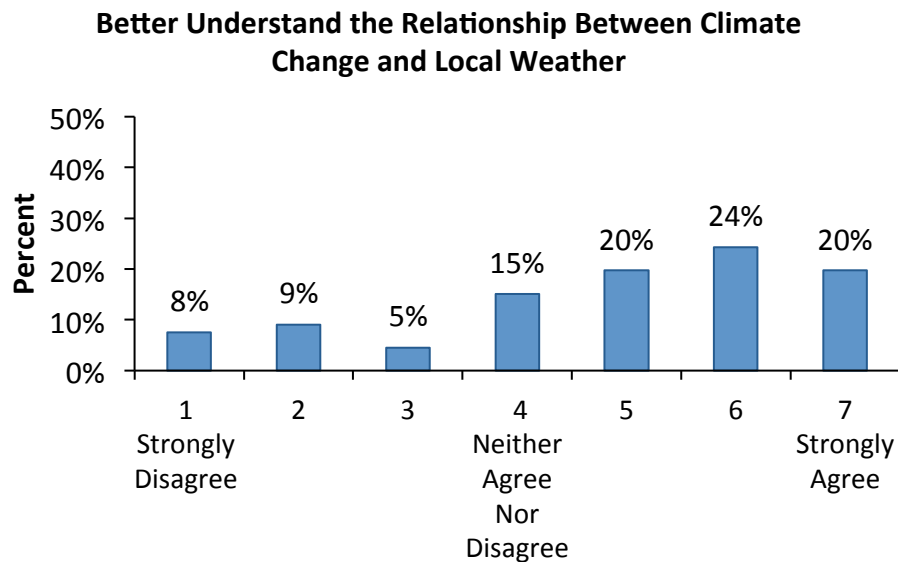
Table 17 Visitor Examples of Local Impacts of Climate Change, Interviews

Categories	n=38	
	Frequency	Percent
Ocean	**17**	**45%**
Sea level rise, general	7	18%
Sea level rise affecting Miami/Florida	4	11%
Coral	4	11%
Ocean miscellaneous	2	5%
Hurricanes & Storms	**15**	**39%**

Said "hurricanes"	8	21%
Examples of hurricanes and storms	2	5%
Described intensity	2	5%
Described frequency	2	5%
Hurricanes miscellaneous	1	3%
Local Weather	**6**	**16%**
Weather is different	3	8%
Temperature	2	5%
Weather miscellaneous	1	3%
General Examples	**4**	**11%**
Saw something about Miami/Florida but not specific	2	5%
The sphere gave examples	1	3%
General miscellaneous	1	3%
Population Growth	**3**	**8%**
Population	3	8%
No Examples	**3**	**8%**
No	2	5%
Not enough time	1	3%
Miscellaneous	**7**	**18%**
Personal story about climate change	2	5%
Miscellaneous, miscellaneous	5	13%

NOTE: Some respondents gave more than one answer, so percentages total more than 100%.

Figure 14 World Cloud[7] for words and phrases used to describe visitor responses to learning about climate change from the exhibit, Interview

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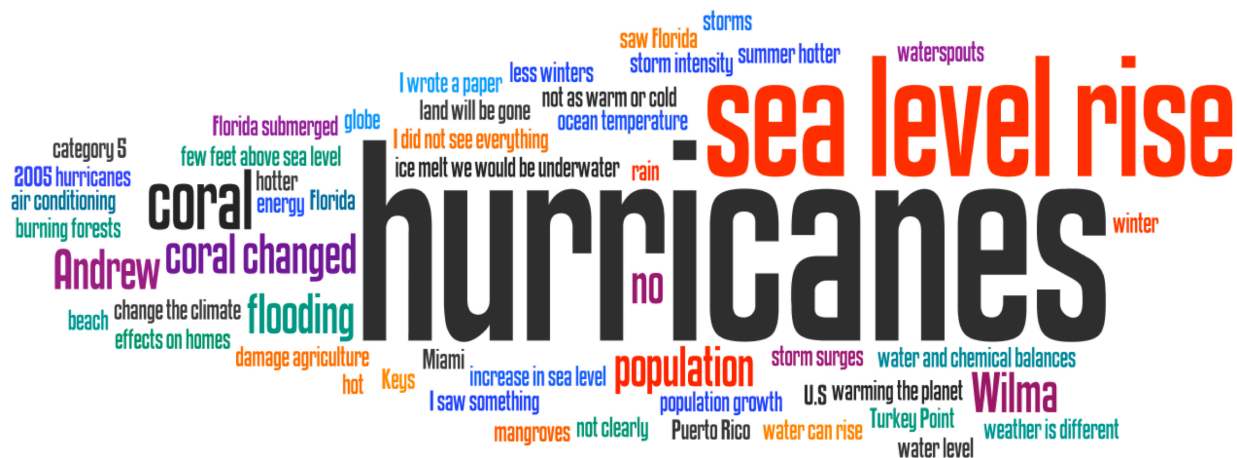
[7] World Cloud was created using the website www.wordle.net

Figure 15 Concern About Impact of Climate Change on Local Area

More Concerned About the Impact of Climate Change on the Local Environment
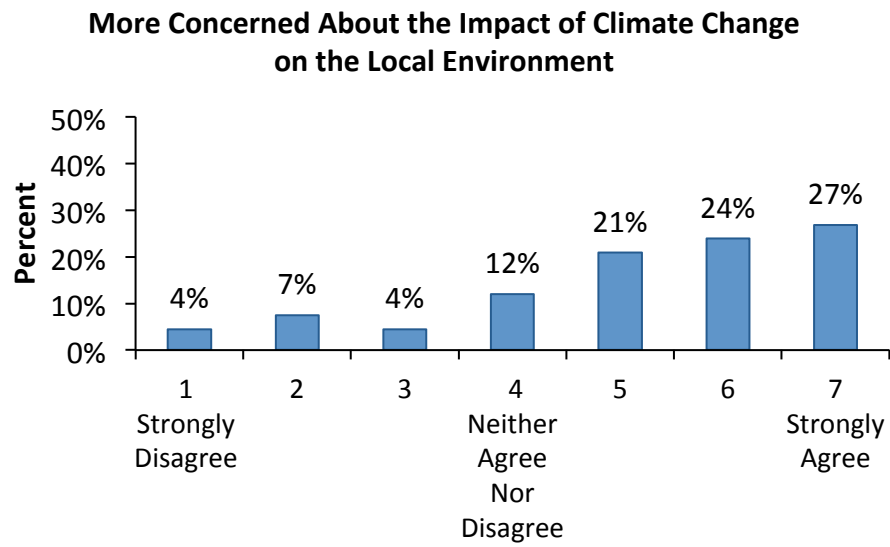
IMPLICATIONS

The following section includes a select group of findings and their related implications for practice, in order to put the findings from the study to broader use. The list below includes a main finding, followed by the corresponding implication(s). The findings focused on groups' behaviors, their reactions to the exhibit, learning about climate change and the importance of personal connections and local issues.

Finding	Implication(s)
ENGAGEMENT WITH EXHIBIT: Groups engaged with the exhibit for 4 minutes; more than two-thirds of the groups spent between 2 and 6 minutes, and nearly one in five spent 7 minutes or more. Nearly all groups controlled the sphere, read the text and physically interacted with the exhibit. In more than half of the groups, more than one person interacted with the exhibit.	The design approach of providing multiple user interfaces was effective in encouraging thorough use of the exhibit. Both the touch screens and the globe were engaging to visitors, suggesting that providing different opportunities to multiple groups can be used effectively to allow various means of engaging an exhibit at the same time. The fact that multiple users within the majority of groups interacted with the exhibits suggests that it has broad appeal. Technology can be incorporated in exhibits so that groups don't have to "line up" and wait for a group to finish
BILINGUAL USE OF EXHIBIT: More than half of the groups were of Hispanic origin, and of this group about half preferred exhibits in English and half preferred them to be bilingual. This was reflected in the language preferences they showed for the exhibit, as about half of the Hispanic/Latino groups read text and spoke to each other in Spanish.	Offering exhibits bilingually, especially in Miami, is a good idea. While not all Hispanic/Latino groups speak Spanish, they often come with varying degrees of English- and Spanish-speaking abilities. Continue to offer exhibits bilingually, as this adds to the experience and provides multiple points of entry to engaging the exhibit.
SOCIAL INTERACTIONS: Of groups interviewed about the exhibit, nearly all were groups with two or more people, and more than half of groups had children in the group. Nearly all of the groups spoke to each other at the exhibit.	The exhibit seemed effective in encouraging social interaction among groups, and was interesting enough to groups that they engaged in conversation about the exhibit content. A combination of interesting visuals, an engaging topic and opportunities to interact with and control the learning experience was a successful approach.
REACTION TO EXHIBIT: Visitors reported equally liking the information and the sphere itself, followed by the interactive component of the experience. What visitors stated as most interesting also included mention of the sphere, information and specific content.	This suggests that interesting content, a "keystone" experience like a sphere, and interactivity is a good formula for providing an engaging and interesting experience for visitors. The fact that the information was seen as a key to the experience suggests that simply providing

	interactive experiences without basing them in solid content would not be as effective an approach as building the technology around the content.
LEARNING ABOUT CLIMATE CHANGE: Environmental messages were clearly received by visitors, for when asked what they learned form the exhibit environmental information was the most common response; climate change was specifically mentioned to this open-ended item by more than one out of ten groups. While many visitors did report learning new information about climate change, there was a sense that many of them felt like they knew the information already.	These findings suggest that science museum visitors are open to learning about the environment and climate change, though they often perceive themselves as knowing the content already. However, since there were many choice points within the sphere experience it is difficult to know exactly which climate change-related information they felt they already knew. Further research with the sphere that specifically addresses which information is novel may suggest ways to further engage visitors on this topic using the exhibit.
PERSONAL CONNECTION TO CLIMATE CHANGE, THROUGH LOCAL ISSUES: More than half of groups said they learned about how climate change directly affects them, referring most commonly to the ocean and hurricanes and storms. More than one third of groups said they learned how they impact climate change. The large majority of groups agreed that the exhibit helped them better understand the relationship between climate change and local weather. These impacts were also affective in nature, as more than half strongly agreed that the exhibit made them more concerned about the impact of climate change on the local environment.	The exhibit's approach of trying to get people to see their connection to climate change, and providing examples of connections to local weather got through to visitors. Helping making a topic like climate change more personal seemed to work, and should be used in future exhibits and programs around climate change. The impact also seemed to go beyond just understanding and knowledge, since getting people more concerned can be an important first step in getting people to take action around a topic or issue. Future efforts should be made to understand the relationship between understanding, concern, and taking action; given this set of findings taking an approach that focuses on local environmental issues seems promising.

Appendix 1 Observation Instrument (showing Touch Screens)
NOTE: Top 4 are Title Screens, next 16 are Sphere Kiosk Screens, Bottom 16 are Local Kiosk Screens

_____ Title screen

_____ Earth's Climate Syst.

_____ Human Impacts

_____ Global Consequences

Date: _____   Data collector: _____

Group #: _____   (match w/interview)

Total time at exhibit: _____ : _____ (min/sec)

Read text: ☐ English ☐ Spanish ☐ Both

Speak in: ☐ English ☐ Spanish ☐ Both

Group control globe: ☐ Yes ☐ No

Notes:

_____ Energy from Sun

_____ Ocean Temp/Curr

_____ Wind Patterns

_____ Current Weather

_____ Population Growth

_____ Electricity Use

_____ Transportation

_____ Global Fires

_____ Temperature Changes

_____ Sea Level Rise

_____ Ocean Acidification

_____ Strong Storms

_____ Energy From Sun

_____ Ocean Temp/Curr

_____ Wind Patterns

_____ Current Weather

_____ Population Growth

_____ Electricity Use

_____ Transportation

_____ Global Fires

_____ Temperature Changes

_____ Sea Level Rise

_____ Ocean Acidification

_____ Strong Storms

Miami Science Museum
Hurricanes and Climate Change Bilingual Study

Introduction

Hi. The museum is getting some feedback from visitors over this exhibit over here [point to sphere]. Would your group have about 10 minutes to first try out the exhibit and then talk to me afterwards about what you thought?

[If Yes] Great, thanks a lot. We'd like you to use the exhibit like you normally would, as if you haven't talked to me, then let me know when you're done and I'll ask you some questions. Just let me know when you're finished – I'll just be over here taking some notes about what you do.

Interview

1. What did you like most about this exhibit?

2. Please complete the following sentence about the exhibit. "I never realized that…."

3. What did you find to be most interesting thing about the exhibit, and why?

4. The exhibit talked some about how the Earth works, which we sometimes refer to as the Earth's systems? Could you tell me, for example, which of the Earth's systems the exhibit talked about?

5. What specifically, if anything, did you learn about <u>climate</u> <u>change</u> from the exhibit?

6. Did the exhibit change, even a little bit, how you <u>feel</u> about climate change?
    □ Yes   □ No

    6a. Why or why not?

7. Did you see any examples of how climate change is affecting things locally, in Florida or Miami?
    □ Yes   □ No

    7a. If Yes, what examples did you see?

Now we just have a few questions we'd like you to fill out yourself.

8. Based on SEEING THIS EXHIBIT, please tell us the degree to which you agree with the following statements.

	Strongly disagree		Neither agree nor disagree			Strongly agree	
I learned new things about how the Earth and its related systems work.	☐	☐	☐	☐	☐	☐	☐
I learned new things about climate change and its impacts.	☐	☐	☐	☐	☐	☐	☐
Climate change is real.	☐	☐	☐	☐	☐	☐	☐
I better understand the relationship between climate change and local weather.	☐	☐	☐	☐	☐	☐	☐
Climate change is caused by human activity.	☐	☐	☐	☐	☐	☐	☐
I feel more concerned about the impact of climate change on the local environment.	☐	☐	☐	☐	☐	☐	☐
I learned more about how climate change directly affects me.	☐	☐	☐	☐	☐	☐	☐
I learned more about how I impact climate change.	☐	☐	☐	☐	☐	☐	☐

9. What year were you born? _____

10. What are the ages of the other people in your group?

____ ____ ____ ____ ____ ____ ____ ____ ____

11. Are you of Hispanic, Latino or Spanish origin?
☐ No
☐ Yes, Mexican, Mexican American, Chicano
☐ Yes, Puerto Rican
☐ Yes, Cuban
☐ Yes, Central American
☐ Yes, Spanish Caribbean
☐ Yes, South American
☐ Yes, Other Hispanic, Latino, Spanish: _____

12.   Which of the following best describes you? *Mark as many as apply.*

□ White   □ Black, African American
□ American Indian or Alaska Native   □ Native Hawaiian
□ Guamanian or Chamorro   □ Samoan
□ Asian Indian   □ Chinese
□ Filipino   □ Japanese
□ Korean   □ Vietnamese
□ Other Asian   □ Other Pacific Islander

13.   Does your group generally prefer to read exhibit text in **English or Spanish, or both?**

□ English   □ Spanish   □ Both   □ Another language: _____

14.   We will be contacting people a couple of weeks from now to ask a few questions about your experience with the exhibit. If you are willing to answer a few very short questions about your experience here today, please clearly write your email address below. **(We will only use your email to ask you questions about this exhibit and nothing else; we will also not distribute or give your email to anyone else).**

Email: _____

Thank you very much for your time!

Introducción
Hola. El Museo desea obtener la opinión del público sobre esta exhibición [señale el globo]. ¿Pudiera su grupo darnos 10 minutos de su tiempo para probar la exhibición y después comentar sobre su experiencia?

[Si la respuesta es sí] Excelente, muchas gracias. Por favor utilicen la exhibición como lo harían normalmente, como si no hubieran hablado conmigo, y luego déjenme saber cuando hayan terminado y les haré algunas preguntas. Sólo déjenme saber cuando hayan terminado – yo estaré acá tomando algunas notas sobre su modo de interacción con la exhibición.

Entrevista
1. ¿Qué fué lo que más le gustó en la exhibición?

2. Por favor complete la siguiente oración sobre la exhibición. "Nunca me había dado cuenta de que…"

3. En su opinión, ¿cuál fue la parte más interesante de la exhibición, y por qué?

4. La exhibición presenta información sobre los procesos de la Tierra, lo que a veces llamamos los sistemas de la Tierra. ¿Me puede decir qué sistemas que fueron mencionados en la exhibición?

5. ¿Qué aprendió específicamente sobre el cambio climático en la exhibición?

6. ¿Cambió la exhibición su opinión sobre el cambio climático, aunque sea un poquito?
    □ Sí   □ No

6a. ¿Por qué sí o por qué no?

7. ¿Vio algún ejemplo de cómo el cambio climático está afectando el ambiente local, en Miami o la Florida?
    □ Sí   □ No

7a. Si la respuesta es sí, ¿qué ejemplos vio?

Ahora le pedimos que usted mismo conteste las últimas preguntas.

8. Basado en lo que VIO EN ESTA EXHIBICIÓN, por favor indique hasta qué punto está de acuerdo con las siguientes oraciones.

	Muy en desacuerdo		No de acuerdo ni desacuerdo			Muy de acuerdo	
Aprendí cosas nuevas sobre los procesos de la Tierra y sus sistemas relacionados.	☐	☐	☐	☐	☐	☐	☐
Aprendí cosas nuevas sobre el cambio climático y su impacto.	☐	☐	☐	☐	☐	☐	☐
El cambio climático es real.	☐	☐	☐	☐	☐	☐	☐
Entiendo mejor la relación entre el cambio climático y las condiciones atmosféricas locales.	☐	☐	☐	☐	☐	☐	☐
La actividad humana es responsable por el cambio climático.	☐	☐	☐	☐	☐	☐	☐
Estoy más preocupado por el impacto del cambio climático en las áreas locales.	☐	☐	☐	☐	☐	☐	☐
Aprendí más sobre cómo el cambio climático me afecta de manera directa.	☐	☐	☐	☐	☐	☐	☐
Aprendí más sobre la forma como yo impacto el cambio climático.	☐	☐	☐	☐	☐	☐	☐

9. ¿En qué año nació? _____

10. ¿Cuáles son las edades de las otras personas en su grupo?

     ____ ____ ____ ____ ____ ____ ____ ____ ____

11. ¿Es usted de origen hispano o latino?
    ☐ No
    ☐ Sí, mexicano, mexicano-americano, chicano
    ☐ Sí, puertorriqueño
    ☐ Sí, cubano
    ☐ Sí, centroamericano
    ☐ Sí, caribeño
    ☐ Sí, suramericano
    ☐ Sí, otro grupo hispano o latino: _____

12.   ¿Cuál de las siguientes palabras le describe mejor? *Marque todas las casillas que mejor le aplican.*

□ blanco   □ negro, afroamericano
□ amerindio o nativo de Alaska   □ Nativo de Hawái
□ Indígena chamorro de Guam   □ Nativo de Samoa
□ Indígena asiático   □ chino
□ Filipino   □ japonés
□ coreano   □ vietnamita
□ otro grupo asiático   □ otro grupo de las Islas del Pacífico

13.   En general, ¿su grupo prefiere leer el texto de la exhibición en **inglés, en español, o en ambos idiomas?**

□ **en inglés**   □ **en español**   □ **en ambos idiomas**   □ **Otro lenguaje:** _____

14.   En dos o tres semanas estaremos contactando a la gente para saber como fue su experiencia en la exhibición. Si esta amable de contestar unas preguntas muy cortas sobre su experiencia en este exhibición, por favor escribe claramente su correo electrónico aquí. **(Solamente vamos a usar su correo electrónico para contactar usted sobre esta exhibición y nada mas; no vamos a distribuir o compartir su correo electrónico con nadie).**

Correo electrónico: _____

¡Muchas gracias por su tiempo!

Appendix 4 Order of Screens Viewed, Observations

Group	Screen 1	Screen 2	Screen 3	Screen 4
1	Title	Energy From Sun	Population	Content-Electricity
2	Title	Energy From Sun	Wind	Ocean Acidification
3	Title	Energy From Sun	Content-Storms	Temperature Changes
4	Title	Ocean Temp/Current	Population	Population
5	Title	Electricity	Wind	Sea Level
6	Title	Ocean Acidification	Content-Ocean Acidification	Population
7				
8	Title	Ocean Temp/Current	Content-Ocean Temp/Current	Electricity
9				
10				
11	Title	Current Weather	Wind	Fires
12	Title	Sea Level	Wind	Stopped
13	Title	Ocean Temp/Current	Energy From Sun	Stopped
14				
15	Title	Ocean Temp/Current	Energy From Sun	Sea Level
16	Title	Ocean Temp/Current	Content-Ocean Temp/Current	Sea Level
17	Title	Temperature Changes	Population	Content-Storms
18	Title	Ocean Temp/Current	Transportation	Population
19	Content-Fire	Content-Wind	Stopped	Stopped
20	Title	Ocean Temp/Current	Temperature Changes	Stopped
21	Title	Electricity	Storms	Stopped
22	Title	Current Weather	Temperature Changes	Fires
23	Title	Ocean Temp/Current	Electricity	Storms
24	Title	Ocean Temp/Current	Sea Level	Fires
25	Title	Fires	Population	Storms
26	Title	Population	Sea Level	Storms
27	Title	Ocean Temp/Current	Population	Current Weather
28	Title	Ocean Temp/Current	Fires	Sea Level
29	Title	Fires	Sea Level	Stopped
30	Sea Level	Title	Energy From Sun	Ocean Temp/Current
31	Title	Ocean Temp/Current	Wind	Sea Level
32	Title	Ocean Temp/Current	Storms	Stopped
33	Content-Ocean Acidification	Title	Storms	Wind
34	Ocean Acidification	Sea Level	Current Weather	Stopped
35	Title	Electricity	Ocean Acidification	Wind
36	Title	Current Weather	Sea Level	Electricity
37	Title	Ocean Temp/Current	Electricity	Population
38	Title	Population	Stopped	Stopped

39	Title	Fires	Storms	Wind
40	Title	Title	Title	Title
41	Title	Energy From Sun	Temperature Changes	Wind
42	Ocean Acidification	Storms	Content-Storms	Content-Wind
43	Storms	Content-Storms	Title	Storms
44	Title	Energy From Sun	Temperature Changes	Content-Storms
45	Content-Energy From the Sun	Content-Storms	Storms	Content-Energy From the Sun
46	Content-Sea Level	Sea Level	Energy From Sun	Storms
47	Content-Sea Level	Transportation	Transportation	Storms
48	Title	Sea Level	Population	Energy From Sun
49	Content-Temperature Changes	Current Weather	Fires	Stopped
50	Title	Ocean Acidification	Electricity	Ocean Temp/Current
51	Title	Population	Ocean Acidification	Energy From Sun
52	Title	Electricity	Energy From Sun	Ocean Temp/Current
53	Title	Ocean Temp/Current	Sea Level	Content-Sea Level
54	Title	Ocean Acidification	Ocean Temp/Current	Energy From Sun
55	Title	Ocean Acidification	Population	Stopped
56	Title	Population	Current Weather	Content-Current Weather
57	Title	Current Weather	Content-Current Weather	Stopped
58	Content-Electricity	Ocean Temp/Current	Content-Ocean Temp/Current	Fires
59	Title	Wind	Ocean Temp/Current	Electricity
60	Content-Electricity	Title	Sea Level	Sea Level
61	Title	Electricity	Wind	Storms
62	Title	Energy From Sun	Content-Energy From the Sun	Energy From Sun
63	Title	Population	Sea Level	Stopped
64	Title	Population	Current Weather	Content-Current Weather
65	Ocean Acidification	Title	Electricity	Storms
66	Transportation	Content-Wind	Title	Ocean Acidification
67	Title	Energy From Sun	Storms	Ocean Acidification
68	Content-Ocean Temp/Current	Title	Ocean Temp/Current	Content-Ocean Temp/Current
69	Content-Energy From the Sun	Title	Population	Population
70	Title	Population	Ocean Temp/Current	Content-Ocean Temp/Current