HANDS ON SCIENCE CENTER

NATIONAL MUSEUM OF AMERICAN HISTORY
KENNETH E. BEHRING CENTER
SMITHSONIAN INSTITUTION

AN EVALUATION BY
OFFICE OF POLICY AND ANALYSIS
SMITHSONIAN INSTITUTION

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Director's Preface

Hands-on science activities are important in explaining scientific concepts, raising questions, engaging participants of all ages in problem-solving, and enjoying guided and self-guided activities. The Hands On Science Center (HOSC) at the Smithsonian's National Museum of American History (NMAH), Kenneth E. Behring Center opened in 1994 and has incorporated new ideas and practices a number of times. In the spring of 2006, Gretchen Jennings, Director of Education for Interpretation and Visitor Studies, and the HOSC Director, Matthew White, asked the Office of Policy and Analysis (OP&A) to evaluate users' satisfaction with the Center and to better understand the demographic characteristics of visitors, as well as whether other characteristics were associated with high or low ratings of satisfaction.

My thanks go to Matthew White for initiating this study and for providing the support necessary for undertaking this study. I would like to acknowledge the contributions of OP&A staff as well as interns and museum staff who engaged in data collection. Observations, interviews, and questionnaire administration are time-consuming research techniques and analysis and triangulation of findings from three sources are labor-intensive. Appendix C, which discusses points made by visitors, and Appendix D, which presents the survey findings, demonstrate the complexity and value of audience research. My guess is that during the period that NMAH is closed for renovation, Matthew White and museum staff will make informed decisions and create modifications to further enhance the Center's activities as a result of this study. Finally, I wish to acknowledge the Director of NMAH, Brent Glass, for his contributions to making this and other visitor studies possible.

Carole Neves
Director
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Background of the study

The Hands On Science Center is a room in the National Museum of American History, Kenneth E. Behring Center, Smithsonian Institution, set up as a bench laboratory with an area of tables in front of the lab bench. Every half hour docents or staff lead small groups of visitors (six or fewer to each experiment) through a hands-on science experiment on one of eight themes. Aside from experiments visitors can pursue self-guided activities at one of nine tables or stations elsewhere in the room.

In spring of 2006, Gretchen Jennings, Director of Education for Interpretation and Visitor Studies, and Matthew White, Director of the Hands On Science Center, requested that staff from the Smithsonian's Office of Policy and Analysis evaluate the Center and provide information about the composition of its audience.

The study design included interviews and observations of visitors to the Center, a survey of exiting visitors, and a group interview with docents and staff who work in the Center. Altogether, 43 interviews were conducted, involving 63 young visitors, ages 6 to 18, and accompanying adults. They ranged in length from a few minutes to over an hour. The self-administered survey of exiting visitors was distributed to one member of each group of visitors leaving the Center over a period of two weeks in July, 2006. In total, 474 questionnaires were completed, with a response rate of 90 percent. The group interview with docents and staff who work in the Center included 10 people.

The purpose of the observations and interviews was to gain a deeper understanding of how the room was being used and what users were getting out of the experience. Interviews were open-ended and took advantage of the activities that users were engaged in.

The purpose of the survey was to determine the basic characteristics of the users of the Center, to measure their satisfaction with the Center, and to ascertain whether particular demographic characteristics or activities were associated with higher (or lower) ratings of satisfaction.

Key findings

Overall, visitors were very pleased with the Center.

> *It's an awesome room.*
> (Boy, 7)

Visitors were asked in the exit survey how much they liked the Center. On a one to ten scale, where one meant "I didn't like it," five or six meant "It's o.k." and ten meant "I loved it," one-third of the visitors (34%) on average choose the top score of ten. This rating is comparable to the ratings for the most popular exhibitions in the museum, *The Price of Freedom*, and the *Star-spangled Banner*.[1] The youngest visitors (ages 5-8) were the happiest – 55% of them gave a rating of 10. Teens (ages 13-17) were least happy – 16% gave a rating of 10. Other age groups were close to the average.

Children were drawn to the Center by a desire for hands-on activities.

> *(I came to the Center) because I wanted to do something that I could touch and feel and learn about more by touching and feeling.* (Girl, 11)

Parents and children told interviewers about their search for hands-on activities at the Smithsonian and why such activities are desirable to them. The room was clearly seen as a place for children. Only three percent of the visitors were adults visiting alone. On average there were over twice as many visitors under the age of 18 for every person over the age of 18 in the Center.

Visitors were drawn to the Center by an interest in science.

> *I love science – not in class – but I love it.*
> (Girl, 13)

Because of its window-wall to the main passageway and its design as a laboratory, visitors passing by immediately knew just by looking at it that the Center was a place for science activity. Those interested in science were immediately attracted to it.

[1] See *Visitor Ratings of Exhibitions at the National Museum of American History, July 2005*, available online at http://www.si.edu/opanda/Reports/Reports/RATINGS.NMAHexit.pdf.

Visitors spoke of the Center as a place for learning.

> *I think you learn more from doing it yourself rather than reading it in a textbook.*
> (Girl, 12)

Through the table activities and the experiments visitors felt that they were learning about science, scientists, and the world in general. Interviewees repeatedly pointed out how the experience of science in the Center differed from reading or school.

On average every other visitor did a bench experiment.

> *We didn't get here in time (to do the bench experiments).* (Girl, 14)

Most adults who said that they did an experiment were observers rather than active participants. Since the experiments take half an hour and start at set times, those in a hurry can only use the tables. Half of the visitors who did not do an experiment spent less than 15 minutes in the Center.

The bench experiments were seen as a special feature of the Center.

> *I liked the small group idea. People show them the experiments….I liked the interaction a lot.*
> (Parent)

Some visitors who had experience with other science centers were asked to compare them to the Hands On Science Center. They identified the bench experiments and the fact that they involved children directly as a key difference with other science centers.

Three experiments were strongly associated with high ratings.

> *It was really fun…I learned about CO2 last year in science class and it was kind of confusing, but here it was really easy to understand.* (Girl, 14)

The 16% of visitors who participated in the **carbon dioxide** experiment were especially happy with the Center – 61% of them gave a rating of ten. Among the 13% of visitors who participated in the **food additive** experiment, 55% rated the room as ten, and Among the 12% who participated in the **polio** experiment, 47% rated the room a ten.

An important feature of the experiments is the equipment used.

I want them to see science from professionals. They have science textbooks in school, but I want them to see from a scientist how they do experiments.
(Parent)

Participants wear safety glasses and use genuine lab equipment, and docents and staff wear lab coats. These features reinforce the feeling among the visitors that they are engaged in real science with real scientists. Docents, some of whom are, in fact, retired scientists, said that they enjoy answering visitors' questions about why they got started as scientists and what it is like to be a scientist.

Younger children were especially drawn to two of the activity tables.

I like (the circuits table and the rocks and fossils); it's more fun than reading out of a textbook or anything.
(Girl, 13)

Visitors engaged with an average of 2.4 activity tables (median=2). Children under 12, who constitute 56 percent of visitors, were the majority of those who used the Circuits table (64%) and the Rocks and Fossils activity (73%).

A number of visitors had difficulty with the DNA activity table.

I wasn't able to figure (the DNA puzzle) out. I didn't read the instructions. It would have helped to have someone to help me.
(Boy,13)

Unlike the other activities, where visitors around the table could pursue independent activities, the puzzles on the DNA table had to be worked on together as a set. This was confusing. In addition, it was impossible to use this activity meaningfully without reading the instructions, and many visitors were inclined not to read anything.

The audience is primarily comprised of local families.

We homeschool and my son is at a conference in DC and we said, "We can go visit Jeff, and while we're here go to the museum."
(Parent)

Although the survey was conducted during the season when local visitors comprise less than 20% of visitors to the museum, 74% of Center visitors live in the District of Columbia, Maryland, or Virginia. Some of these visitors are home-schoolers.

Most visitors do not know of the Center before they see it.

> *We read about it in Smithsonian Magazine and this Washington, DC tour-guide thing.* (Girl, 12)

Most visitors first learn about the Center when they see it as they move through the museum (69%). One out of ten are repeat visitors. The rest either heard about it (16%) or saw it on the Internet (5%).

Most visitors spend between 15 minutes and an hour in the Center.

Because half of the visitors participate in one half-hour experiment, the median time in the Center is between 15 and 30 minutes. One-quarter, who do no experiments, stay less than 15 minutes, and 50% stay longer than half an hour.

Suggestions from visitors

Offer visitors a log or journal for recording their experiments.

> *I like illustrating the setup of the experiments.*
> (Girl, 11)
> *I like how you can look back and see what you did.*
> (Boy, 8)

Both children and adults mentioned the value of having a notebook in which to record the details of an experiment. Note-taking is incorporated into just one of the current bench experiments (Paving Stones).

Suggest follow-up activities that could be continued at home.

> *I would like things you could do here and then take them home, and do them any time you wanted to by using simple things…*
> (Boy, 8)

Some adults and children said that they would have liked something that they could use to continue or follow-up on the excitement generated by the experiments. Although they specifically mentioned hand-outs, a website could also serve such a purpose.

Improve the graphic design of the Center.

> *Add some different colors, if that's allowed. It's kind of bland. The only thing colorful is that sign up there.* (Parent)

An OP&A observer noted that visitors missed table activities that would have interested them because the nature of the activities was not clear immediately. A sign system that identified the activity from a distance would help visitors orient themselves to the topics that most interest them.

Discussion

The Hands On Science Center is one of the most popular and successful locations within the American History museum, often running at capacity.

As noted in the interviews, when visitors compare it to other science centers, they comment favorably on the participatory bench experiments run by staff and docents, a special feature of the Center.

The activity tables also draw considerable attention. Thanks to the written instructions, the help of accompanying adults, and the intercession of staff and docents, children of varying ages were able to engage the activities.

Only the DNA table activity appears to be seriously flawed and should be considered for revision or replacement. The biggest problems with the other tables were maintenance and visibility.

The Center is especially attractive for children inclined towards scientific thinking or who have already identified with science. By its physical setup and ancillary features, such as equipment, lab coats, protective glasses, etc., it communicates that science is something special; and by the clear and engaging character of its activities, it encourages children to believe that scientific investigation is within their grasp.

The high ratings that both young children and adults give the Center demonstrate that the room is not only effective and engaging, but also pleasurable.

Appendix A: History of the Hands On Science Center

By Matthew White, Director

The Hands On Science Center opened at the Smithsonian's National Museum of American History, Behring Center in April, 1994 as part of the *Science in American Life* (*SAL*) exhibition. The Center is an essential learning component for museum visitors seeking a deeper and more practical understanding of the role science plays in our daily life. The early experiments and activities were mostly wet chemistry and connected directly to topics and displays in *SAL*. From the beginning the goals of the Center have been to:

- Provide opportunities for visitors to **do** contemporary and historical science experiments and activities with family, classmates or social groups in an entertaining and relaxed setting;

- Provide opportunities for visitors of all ages, abilities and interests to engage in critical thinking and problem solving;

- Encourage visitors to ask questions, and to provide them with hands-on activities and resources to seek answers (or frame their next question); and

- Incorporate and amplify science topics that are presented within a social and historical context from exhibitions throughout the Museum.

The Hands On Science Center is designed with four different types of activities. First are the self-guided activities, often referred to as *Exploration Stations*. These stations are self-contained with all necessary instructions and materials. They include activities on radioactivity, stereoisomers, IQ testing, electrical circuits, DNA, and puzzles. The second set of activities is the *Experiments*. These require facilitation by trained HOSC staff. When the room was originally constructed, these experiments were also self-guided, but it was soon determined that these activities were too complicated for the public to complete on their own and the current system has been in place ever since. The third set of activities is less than active. HOSC has a series of displays or machines that the public can watch and read about. When the Center opened in 1994, there were two such displays, a working still and a $C0_2$ analyzer. The $C0_2$ was difficult to maintain and is currently unavailable. The last activity is the Teacher's Resource Corner stocked with books, curricula, and other resources for teachers. This corner has proven less than successful, but many parents and other adults find it interesting.

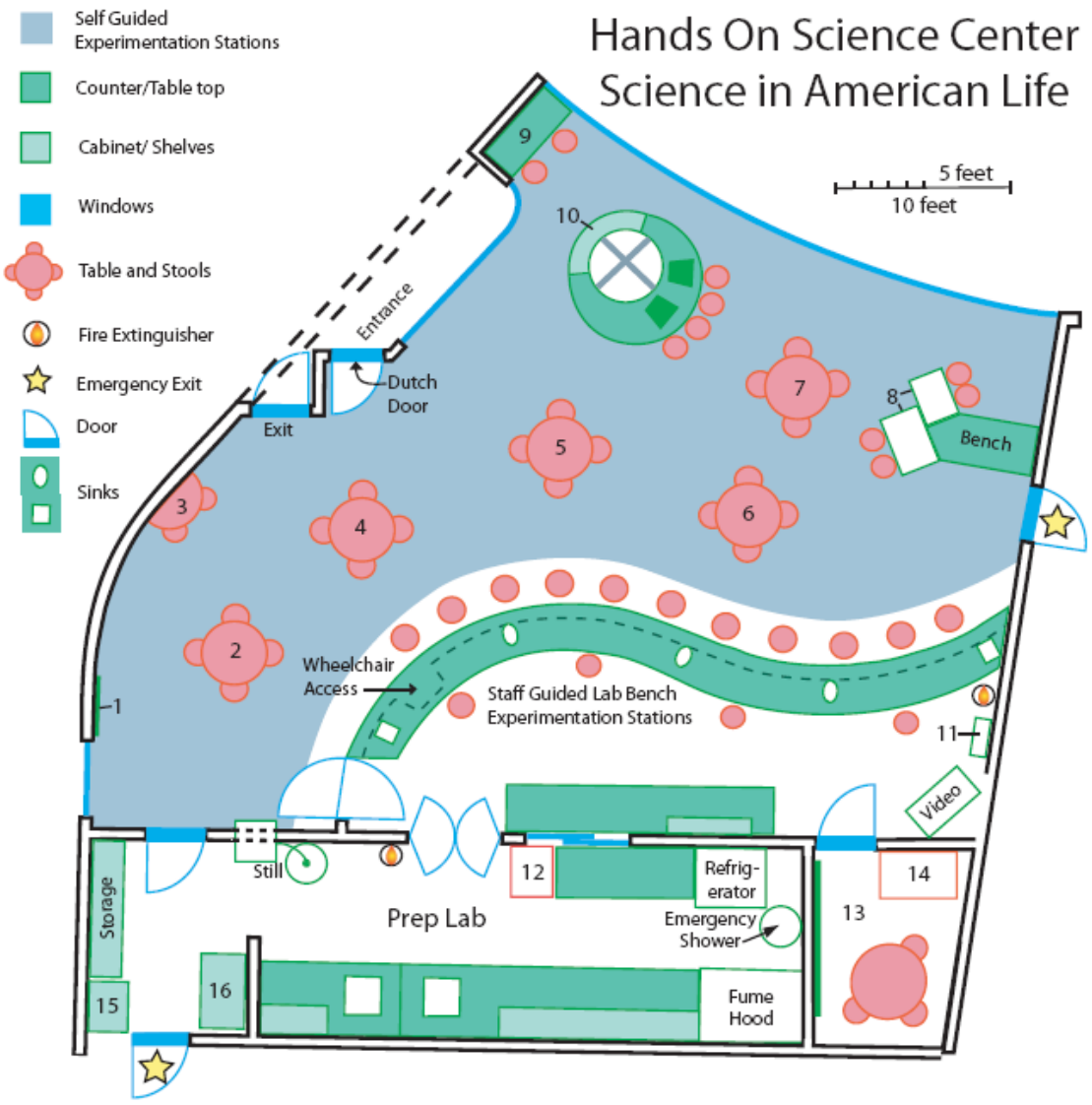
It should also be noted that when HOSC originally opened it had a computer interactive on the subject of Global Climate Change. Although this program was popular, the technology and software became dated as the 1990's turned into the 2000's. This obsolescence coupled with the rise in the internet, which allowed visitors to enjoy these types of interactives at home, led HOSC staff to discontinue this activity in 2002.

Although the earliest activities were chemistry experiments and tied directly to components in *SAL*, in 1999 HOSC expanded its experiment repertoire to highlight other areas of the National Museum of American History. At that time HOSC began to explicitly connect with the scientific content in many different exhibitions in the museum. The first experiment in this new mold was the *Star-Spangled Banner*. This experiment invites visitors to recreate the experiments and procedures that many different types of scientists performed on the museum's most important artifact. This peek at the "science of history" proved so popular; that a second activity of this type was undertaken, albeit on the World Wide Web, and not in the room. This activity, entitled *You Be the Historian*, invites web surfers to analyze Puerto Rican statues of Catholic Saints as a conservator would and to listen to tales of those who made them. After the success of those two activities, the Hands On Science Center has worked with a number of exhibitions to create new experiments and stations including *West Point and America, America on the Move*, and *Whatever Happened to Polio?*

Currently the Hands On Science Center offers eight experiments:

- The Star-Spangled Banner
- Extracting DNA
- Lasers
- Life's a Gas: $C0_2$
- Whatever Happened to Polio?
- Paving the Way
- Food Additives
- Testing the Waters

Appendix B: Map of the Hands On Science Center



Legend

1 - Laser Target
2 - Test your IQ Station
3 - Exploring the Frontier Station
4 - Radioactivity Station
5 - DNA Forensics Station
6 - Electrical Circuts Station
7 - Puzzles Station
8 - How Lasers Work Station
9 - Mirror Molecules Station
10 - Resource Center
11 - Safety Glasses Sterilizer
12 - Dry Ice Cart
13 - Staff Room
14 - Staff Desk/Computer
15 - Bases and Corrosive Chemicals Storage Unit
16 - Flammable Chemicals Storage Unit

Appendix C: Points Made by Visitors in Interviews

It was really exciting learning about, doing hands-on science experiments. Some kids don't get to have that experience. I wish more kids could come here and have fun like me. (Boy, 13)

The attraction of hands-on activities

How did they know about the Center?

In the course of interviews, visitors mentioned seven ways that they found out about the Hands On Science Center:

- **Tour**
- **Brochures**
- **Seeing it**
- **Previous visit**
- **Word of mouth**
- **Video in the visitor's center in the SI Castle**
- **Internet**

Tour

We took a bus tour that came here for lunch, and we explored. I think we might be coming back tomorrow. We wanted to come here because you can do stuff here.
(Girl, 13)

Brochure

We just saw about the center in the brochure. We wanted to come to NMAH, but we didn't know about the science center until we got here.
(Parent with three children, ages 6, 10, and 13)

Saw it

Interviewer: How did you happen to visit here today?
Girl: Well, she's on a business trip for her work and she invited me to come and it was my Christmas gift. She's my Grandma.

Interviewer: What did you do today? How did you happen to come to this room?
Girl: We came to a couple of museums yesterday and we walked by on a tour and we saw this, and I said I wanted to come here, so we went to lunch and came here.
(Girl, 11)

Previous visit

Respondent: Yes, we had been coming back to the American History museum on several occasions and were working our way through.
Interviewer: You live locally?
Respondent: We do now, we moved here this year and decided to homeschool the kids, so that we could take advantage of this area.
Interviewer: so this is your first time in the Hands On Science Center?
Respondent: Yes, I keep saying, "guys, I want to go to the Hands On Science Center."
(Mother of two children, ages 8 and 11)

Word of mouth

We heard about this place because our school comes here each year, the freshman class. But this is our first time. The class hasn't come yet.
(Girl, 15)

Travel guides

We read about it in Smithsonian Magazine and this Washington DC tour-guide thing – "What to do."

Castle video

We saw something about it in the video at the Castle.

Internet

Interviewer: did you know this was here?
Respondent: Not until we went online to see what we were going to do.

NMAH Map

So I went over and studied the map and the first thing that found me was the discovery room and I really like hands-on stuff so… I wanted to come down here.
(Boy, 11)

Within the SI visit

Within the context of the Smithsonian visit, the Hands On Science Center was mentioned as being desirable because

- **Visitors were seeking hands-on activities at all Smithsonian museums**
- **Hands-on activities were more interesting for kids than the rest of the museum**
- **Children find hands-on activities inherently pleasurable**

Some kids are seeking hands-on activities

Although Jasmine has been looking for hands-on activities at each of the SI museums. There's not so many here. She's been seeking these kinds of this out.
(Parent of Girl, 10)

Most interesting part of the museum for some kids

Interviewer: What kinds of ideas would you bring from some of these other places to make this a more interesting or fun place for kids?
Respondent: I'd say a lot more of the hands-on stuff. Are you talking about just this lab or the museum itself?
Respondent: I think one thing that's really worked at the [MN] Science Museum and not even with just the science stuff almost every exhibit you go to there's hands-on stuff. The kids aren't just walking through and reading about things, but they're doing something. There's a button to push or something to watch, or little objects to manipulate. That really draws kids in because once they start doing that, they're going to stop and read and find out what it is they're doing.
Respondent: I agree. Our kids were here for 2 and a half hours, we have 45 minutes left to go, and when there was an hour left there was already kids just sitting on the benches [saying] 'I'm bored,' 'Let's go.' Meanwhile they've probably been in to maybe one or two galleries. And even in those they're sprinting through. But probably all of our kids have already been through this lab and in fact we were in earlier with a table of them that were in here for a good twenty minutes because they see hands-on and they want to go to that.
(Middle-school teachers)

Joy of hands-on

It's hands-on -- instead of people just showing you stuff, showing you how to do it.
(Boy, 8)

Interviewer: Why did you have fun?
Respondent: Because I got to do the experiments and not have somebody else show me it and not let me do it.
(Girl, 7)

Mom: Why did we come to this room?

Girl: Because I wanted to do something that I could touch and feel and learn about more by touching and feeling
(Girl, 11)

Developing the link to science

Interest in science

Also some were attracted to the Center simply because of an attraction to hands-on activities, a number of interviewees expressed a strong interest in science. Some of the sub-themes that emerged in this respect included:

- **Science is encouraged in girls by adults**
- **Science is linked to personality by adults**
- **"I love science"**
- **Enjoying science is linked to "trying out things"**
- **The Center supports an interest in science**
- **Some kids like science, but not as done in school**

Encouraged in girls by adults

And science is so important for girls. She loves animals and science and all of that.
(Mother of girl, 7)

Linked to personality by adults

She's got a very good scientific mind. She's always writing notes down, keeping track of things. I've always told her she'd be a good a scientist. In fact, when I grew up, women were not encouraged to be scientists.
(Grandmother of girl, 10)

"I love science"

Interviewer: Do you like science?
Girl: Yes, I love science
(Girl, 13)

Interviewer: What do you think is the best part of this room? We want to make it better for you. If you were the boss, how could we make it better?
Boy: It's an awesome room.
Interviewer: What do you like about it?

Boy: Because you can do all sorts of stuff. You can do science. Science is my favorite thing.
Interviewer: which one?
Boy: chemistry.
(Boy, 7)

Enjoying science is linked to "trying out things"

Interviewer: What do you like about science?
Girl: You get to try out the things.
Interviewer: Was there anything that surprised you?
Girl: That you were actually going to do some.
Interviewer: What's your favorite kind of museum?
Girl: Science museums.
(Girl, 10)

The room supports an interest in science

Interviewer: Do you like science?
Boy: Hmmm, sometimes.
Interviewer: How did you like this room in terms of the hands-on things it had for you?
Boy: Well, they really do have your different fields of science subjects and all that, and it really does offer you a chance to like it more.
(Boy, 11)

Some kids like science, but not as done in school

Interviewer: Do you like science?
Girl: I love science -- not in class -- but I love it.
(Girl, 13)

Direct Learning

Some children spoke of learning as a part of their experience in the Center. This learning included:

- **Learning about science**
- **Learning about scientists**
- **Learning new facts about the world**

Science

Interviewer: What do you think the purpose of a place like this is?
Girl1: So you can learn about it without like reading it from a textbook so you can understand it better.

Interviewer: Do you think you learn more from doing it yourself?
Girl1: I think you learn from doing it yourself rather than reading it in a textbook.
Girl2: I thought it makes it much easier because then you can actually see what's going on… and it's more fun.
(Girls, 12)

Scientists

[In the Hands on Science Center] I learned about scientists. Scientists have to take notes to present to other scientists and the world.
(Boy, 13)

Interviewer: What about scientists?
Boy: they invent experiments
Interviewer: Why do they do that?
Boy: Because they like to. Because they need to.
Interviewer: why do they need to?
Boy: If it doesn't work, they need to keep trying.

Interviewer: So is that an important part of being a scientist?
Boy: They have to keep trying.
(Boy, 7)

Here at the Hands On Science Center they can see how science works. This is their first time at the museum. I want them to see science from professionals. They have science textbooks in school, but I want them to see from a scientist how they do experiments. To take it one step further.
(Teacher with a first-grade class)

Learning new facts about the world

Interviewer: what did you like?
Girl: Everything.
Interviewer: Was there something special that you liked?
Girl: I liked when he said that all those little creatures make those big shells.
….
Respondent: I'm surprised she didn't talk about the bubbles coming out. But more it's just the "WOW! all those little things turn into that shell."
(Girl, 7, and her parent)

Learning how to experiment

Interviewer: What's good about this [science center]?
Girl: It's more of… you learn new things instead of… like at the New York one you don't really get a chance to learn something, you really just follow the directions and put something together and then you're done with it. But then this one, it's more of you read

the directions and then you try it a couple times and sometimes it doesn't work cause you're not doing it right, so it's different.
(Girl, 11)

Learning new connections between science and daily life

Interviewer: What did you think of it?
Girl: I don't know. It was scientific.
Interviewer: What did you learn?
Girl: About science and food coloring.

Interviewer: Is food coloring a good thing or a bad thing?
Girl: Sort of a good thing, because it helps kids take the medicine, because if they see it and it looks yucky, they're not going to want to take it.
Interviewer: And the bad?
Girl: the bad part is that it has....ah....
Interviewer: Have you thought of these things before?
Girl: No. Not at all. You have to use the potions to find out if the strength is good enough or bad, because if it said that one spilled out everywhere and you didn't know if it was in there or not, you'd have to check that potion.
(Girl, 8)

Indirect learning

In order to investigate deeper levels of learning, interviews sometimes addressed:

- **Scientific method**
- **The nature of experimentation**

Scientific method

Interviewer: Did they think about the scientific process?
Respondent: I'd say no. Our son (11) is a true scientist at heart, so I think he thinks a lot along those lines, but probably not put it into words. Our daughter (9) is not a scientist type. She just came to see things she could touch. Our kids do a lot of reading at school. Our son reads a lot on his own. So I don't think they came here to read.
(Parent)

What is an experiment?

Interviewer: What is an experiment?
Girl: When they mix stuff together.
(Girl, 8)

Interviewer: What is an experiment?

Respondent: An experiment is something that you don't know and something that you want to find out.
(Girl, 9)

Interviewer: What is an experiment?
Boy: It's something that you can test out, see what the results are.
(Boy, 11)

Interviewer: What in your opinion is an experiment?
Girl1: An experiment is something that you do to see what it turns out to be…so like if you mix two chemicals together, see what it will turn out to be like.
Girl2: An experiment is using a number of different things and experiencing something that happens to them.
(Girls, 11 and 12)

Interviewer: What's your definition of an experiment?
Girl1: Opening up a frog; I had do it, it was gross.
Girl2: I think it's where you try to find stuff out
Girl3: Try and find a solution
(Girls, 13 and 14)

Relationship to history

When some children were asked about the relationship between history and science, several cited the activity of calculating the distance to the moon.

Measuring moon distance was consciously linked to history

Interviewer: Did you pick anything up about the relationship between history and science?
Girl: The moon about the history of the Apollo 11 I thought it was cool about the laser, how it reflected off.
(Girl, 12)

Interviewer: In this room, have you gotten anything about the relationship between history and science?
Girl: Well, with the moon thing, that's about it.
(Girl, 13)

Impact and follow-up

The activities and experiments in the Center were linked to:

- **School**
- **Home**

HOSC supplements what is learned in school

Interviewer: does this reinforce things that you have to study in school?
Girl: Some things do. I'm not learning any of this right now, but I have learned some of it before.
(Girl, 8)

Doing science at home

Interviewer: Do you do experiments at home?
Boy: Yes. When I do experiments I put chemicals in them. First you put water in there and then you mix the water with the chemicals and it will make the colors.

Interviewer: Does it sometimes not work?
Boy: Usually it works, but sometimes it doesn't.

Interviewer: What do you do then?
Boy: I try again.
(Boy, 7)

Interviewer: Did watching this experiment give you ideas of what you could do?
Respondent: Yes. They did the fruit juice experiment and they did a titration to find out how much vitamin C was in it and I was thinking that another thing we could do would be to use litmus paper.
Interviewer: Could you test for vitamin C at home?
Respondent: Starch you can buy in the grocery store. Liquid starch.
Girl: It's thicker.
Respondent: I don't know. It might have to be diluted. It would be nice to have a handout for a person who comes or a teacher who goes back to the classroom, to do it again.
Interviewer: We have a lot of foods that say, "vitamin C added."
Respondent: And iodine you can buy in the pharmacy.
(Girl, 11, and her mother)

Compared to other science centers

Some visitors who had experience with other science centers were asked to compare them to the Hands On Science Center. They noted that:

- **The bench experiments were something new**
- **The bench experiments involve the kids directly**
- **The tables have a good mix of experimentation and reading**

Bench Experiments are something new

Respondent: We're from Oxford, TN, and there are a couple of places like this, and Oak Ridge.
Interviewer: How does this compare?
Respondent: It compares pretty well. I haven't seen the experiments they're doing [the demonstrations] very closely, but I'd say it's pretty good. We haven't been to anything that had this kind of demonstration set up, and the hands-on part of it is good. They get to see all the equipment and they can touch it. That's what drew our kids.
(Parent of two girls, 10 and 13, and a boy, 6)

Bench experiments involve kids directly

Interviewer: Tell me about your experience in this room, and then we'll talk to the kids, as well.
Respondent: I was quite pleased. I was really surprised. I liked the small group idea. People show them the experiments. It is a lot more than other museums I've gone too, where they let you push a button and watch it. I liked the interaction a lot.
(Parent of two girls, 9 and 11, and a boy, 8)

Interviewer: Have you been to other science centers?
Respondent: Yes
Interviewer: How does this one compare?
Respondent: I think this one is really cool because the other one, people just showed you how to do stuff, and didn't give you a chance to see how it's done.
Interviewer: Did they have this kind of experiment where you have a scientist helping you?
Respondent: No, not that I remember
(Boy, 10)

The mix of experimentation and instructions at the tables

Interviewer: Have you been to other science centers?
Girl1: yeah, the one in Philadelphia and the one in New York.
Interviewer: What's your favorite science center?
Girl1: I've also been to one in Boston; I like the one in Boston.
Girl2: I like this one
Interviewer: What's good about this one?

Girl2: It's more of… you learn new things instead of… like at the New York one you don't really get a chance to learn something, you really just follow the directions and put something together and then you're done with it. But then this one, it's more of you read the directions and then you try it a couple times and sometimes it doesn't work cause you're not doing it right, so it's different.
(Girls, 11 and 12)

Bench Experiments

The gear makes it special

Interviewer: Do you experiments in school?
Girl: Not like this. We don't have the glasses, and we don't have the equipment.
Interviewer: Why do you think we have it here?
Girl: For kids to learn what they're learning about.
(Girl, 11)

CARBON DIOXIDE

Blowing bubbles

Interviewer: What was the best part?
R2: When you blow bubbles.
Interviewer: Did you know about dry ice before?
R2: yes.
Interviewer: So you pretty much knew that stuff already?
R2: Yes.
(Girl, 10)

Learning

Girl: I really liked the carbon dioxide experiment
Interviewer: What did you like about it?
Girl: Well, it was all fun. I liked the part where you put out the candle by pouring it. At school last year, we had this five days in different weeks that were science days. We learned about fluid. Not just carbon dioxide -- all gases are fluids. It is interesting how that demonstrated it.
Interviewer: Did you like that carbon dioxide experiment"
Boy: Yeah. It was fun that you got to mix things a lot.
Girl: Compounds.
Interviewer: Did that experiment have an hypothesis to it?
Boy: Not really.
Girl: We could have stopped and made one.

Interviewer: Did you actually investigate anything there? What about with the straw?
Girl: Oh yeah. What would it do?
Respondent: Because your breathing into it was your breath. You didn't know when you did that that it was going to turn that indicator blue or take the blue away.
Interviewer: Wasn't there a missing link there? Why is carbon dioxide acidic?
Girl: Also, when we added the other thing, why did it make it basic? Because the chalk was basic.
Respondent: What was the other thing?
Girl: Ca, one O, and there's a two.
Boy: Limewater
Interviewer: What is the chemical name for it?
Girl: Ca is the calcium calcium something oxide. Calcium hydroxide. So I guess just adding more oxygens chalk had more oxygens.
(Boy, 8, and Girl, 11)

Girl: I thought it was really fun and we just did the carbon dioxide experiment. We learned how it -- about the acids and the bases and how they're detected.
Interviewer: Was it fun?
Girl: It was very fun. I was glad I did it.
Interviewer: Have you done anything like that before?
Girl: No, I really haven't.
(Girl, 11)

Interviewer: Which experiment did you just do?
Girl1: We did the carbon dioxide experiment, and we learned how that if you put in acid, like carbon dioxide, in thymol blue, that it will change to yellow, a different color. And then we put straws into the thymol blue and then we blew into it since we blow out carbon dioxide and it turned yellow. And then he told us a bunch of facts about carbon dioxide.
Interviewer: Did you learn anything that you can relate to your everyday life?
Girl1: Well, he told us about there is global warming going on, and that's carbon dioxide, so that relates to the world.
Interviewer: You were saying it was fun… can you explain why?
Girl2: Yes, it was really fun. We were doing experiments while he was teaching us about carbon dioxide and I learned about CO2 last year in science class and it was kind of confusing, but when I came to hear him it was really easy to understand, and I thought he was a really good teacher.
(Girl, 16, and Girl, 14)

Interviewer: And you just did the carbon dioxide experiment what did you think of it?
Respondent: It was pretty neat, how it puts out fire and how it steams and stuff.
Interviewer: Had you learned about carbon dioxide at school?
Respondent: I don't think so.
(Boy, 10)

FOOD ADDITIVES

Testing hypotheses

Interviewer: Did you like that experiment?
Boy: Yes.
Interviewer: What part did you like best?
Boy: the changing colors
Interviewer: What part did you like best?
Girl: probably the changing, like in the filter, you could see what it is doing.
Interviewer: How would you describe what you did as a scientist there with that experiment?
Girl: We tested how much vitamin C was in each of the [inaudible] by putting in iodine, which is a vitamin C detector, or indicator.
Interviewer: Before you started, did you take a guess about what might happen?
Girl: Yes. I thought it was going to be the Kool Aid, because we looked at the package and I thought it had vitamin C added. I thought they would have added a lot of vitamin C.
Boy: I thought it was going to be fruit juice because fruit juice often has a lot of vitamin C.
Interviewer: And which one did it turn out to be?
B,Girl: fruit juice.
(Boy, 8, and Girl, 11)

POLIO

How everything is transmitted

Interviewer: What did you do in the science center today?
Girl: For the man one we did a thing with the polio experiment and then there was a bunch of the other stations which are really fun.
Interviewer: About the polio experiment… did you enjoy that?
Girl: Yeah, it was really fun.
Interviewer: Why was it fun?
Girl: Because you get to figure stuff out on your own, you don't have to look it up, it's a lot funner just to be able to do it yourself.

Interviewer: Did you learn some stuff?
Girl: Yeah, I learned about how everything is transmitted and infects.
(Girl, 7)

Tables

Reading instructions

Some kids don't want to read the instructions

Interviewer: When you sit down at a table like this [puzzles] do you just start working with it and see if you can intuitively figure it out or do you like to read instructions?
Girl1: I just like to figure it out
Girl2: I don't like to read
Girl3: Me either
Girl1: He does not read instructions at all!
Girl2: He doesn't read anything…like do not touch signs; he's not good with those.
Girl3: Then he actually found one that said 'of touch'
Boy: I like to just jump in and try to figure it out
(Girls, 13, and Boy, 13)

Instructions are well-done

Interviewer: Is what you are supposed to do pretty evident at the tables or do you think it's hard to figure out?
Girl1: With these little books on the side it makes it easier to help you because it gives you a question and then all through the inside it tells you the answer.
Girl2: I did a lot of this stuff earlier this year so its not very new to me.
(Girls, 12)

Interviewer: Did you find that here? Or did you find that you had to read a lot?
Girl: You do have to read instructions but it's kind of fun because you get to do things with the instructions.
(Girl, 11)

Some kids like to read the instructions

Some of the activities at the other ones, everything you can do is hands-on. You can do everything, but there's nothing to read. That's different from here. Here you get to do stuff AND read.
(Boy, 11)

Interviewer: I'm curious if you sit down at one of these tables, are you more likely to jump in and try to intuitively figure it out or do you prefer to read instructions about what you are doing before you do it?
Girl: I like to read instructions because if you're doing a science experiment in real life you can mess up. So, I just like to read instructions through in case I do something wrong. I like to read directions.
(Girl, 12)

Instructions can be useful

Interviewer: Did you think [the DNA game] was kind of easy to follow (and I know your dad was helping you) or was it a little difficult?
Girl: It was easy to follow for me because I was reading it. But I don't know…
Boy: It is kind of hard for me since I wasn't reading
(Girl, 10, and Boy, 7)

Instructions can be fun

Interviewer: Did you find that here? Or did you find that you had to read a lot?
Respondent: You do have to read instructions but it's kind of fun because you get to do things with the instructions.
(Girl, 12)

Jumping in first, then reading

Interviewer: So [learning is]something you can pick up intuitively or at least by trial and error…
Respondent: Yeah, which is good science a lot of times.
Respondent: Obviously with any argument there is going to be an exception to every rule. I think there are some kids who would come in and read an entire book on the shelf before they did anything. There are some kids that just function that way. There are some kids who are visual learners and they like to read first and are more analytical. But I would say the majority of kids these days are going to jump into something and want to do it first, especially when they are with a group of friends. We say this all the time; kids are different alone than they are with their friends. Everyone knows that. And if you were to have a kid come in alone and sit down, he or she might be more inclined to go through the thought process. But when they are with a group of friends, especially middle school age kids, they are constantly wanting to be perceived as not too nerdy and they want to make sure they're cool, and if one kid says 'this is lame' then the kids around them are going to say 'you're right, this is lame.' They're not going to want to say, "wait a minute, this is cool, let's slow down and read through this.' If a bunch of kids start bulling through things and throwing things around, then that's what the kids are going to do. So I also think it would affect it if you had a bigger group of kids coming through and affecting how they're interpreting it.
(Middle-school teachers)

It's not as good if you look at the answer

Boy: It's better to do [the puzzles] by yourself, because if you do, then you really know it.
(Boy, 7)

Assistance

When help is needed

Interviewer: If there had been someone there to help [with the laser table], would you have wanted someone to explain it?
Boy: It would be funner to try on your own, and then they could come over.
Girl: Sometimes adults end up teaching you and doing it for you, and then it's not really fun.
Boy: Yes.
Interviewer: If there had been someone standing around from the center, would you have asked the person to come and show you how it worked?
Girl: After we tried to do it.
(Boy, 8, and girl, 11)

Interviewer: What should we change?
Girl: I would like them to have people, lab assistant people, come around and check on what you're doing, and explain things further if you're not understanding it. I would want to do it myself first, but then they could explain it further. It would be weird to have someone just sit down and try to help you, who you don't even know. It would be okay if they asked if I wanted help.
(Girl, 13)

It would have helped at the DNA to have someone to help me.
(Boy, 13)

DNA TABLE

Difficult

Girl: Unless you read all the instructions, it's like, just, put the blocks where they fit.
Interviewer: Do you like reading instructions to figure something out, or do you just want to sit down and do it?
Girl: I like to sit down and do it. I wasn't able to do the DNA experiment. I liked the puzzle part of it, but I couldn't figure it out.
(Girl, 11)

The DNA experiment was confusing. My daughter's 9 and she lost interest very quickly because she didn't know what to do with it. My son was interested in the DNA because he likes biology. He figured it out. He's 11. He didn't know what he was supposed to be doing, and he went through the book. That got him on track. He's an instruction follower, that's the way he works. Our daughter isn't, she's real visual, and she's not a big reader.
(Parent)

I did the laser experiment, and the circuit one, the radioactive one, the DNA one. They were all VERY challenging. They were…how can I put this…they were like an alarm clock to the brain, waking it up, making it think, process cells to move fast. I sat down and

did them. It was pretty fun. The DNA experiment was very interesting. I wasn't able to figure it out. I didn't read the instructions. It would have helped to have someone to help me.
(Boy, 13)

[The DNA] one was confusing because you had to work on four boards at the same time. Four different people came up and they didn't know. We were reading everything so it took a long time. Some people came and started to interrupt and we had to say, "We're still working on it."
(Parent of boy, 11, and girl, 12)

Interviewer: Did you think [the DNA game] was kind of easy to follow (and I know your dad was helping you) or was it a little difficult?
Girl: It was easy to follow for me because I was reading it. But I don't know…
Boy: It is kind of hard for me since I wasn't reading
Interviewer: Dad, what is your opinion about the level of activity?
Respondent: Well I think in some ways it is a little too hard for them. I couldn't understand what Cat has to do with these separate bars on the gel board. I didn't even quite understand why it was gel board, that's the word used in there. So in that sense it was too hard to figure out for them. In another sense it was too easy because in the end you put magnets on and you could just line up the magnets and you didn't necessarily have to know about DNA to figure that out. You could just understand that magnets stuck there and that it matched. I thought the other examples in the book were a little bit easier to figure out, but they also seemed to have a pretty easy level.
(Boy, 7, girl, 10, and their father)

Interviewer: Have you done other activities besides the puzzle table?
Girl: I did the circuit one, and I think the DNA one. I didn't really understand the DNA one.
Interviewer: Did it not make sense when you started doing it, or were the instructions not really good?
Girl: I just probably didn't read the instructions. I put it together so it fit and I found where the little things went and then I just didn't bother solving it.
(Girl, 18)

Interviewer: How would you rate the activities generally… were they pretty easy to follow and understand?
Girl: No (chorus)
Girl: Some of them I think you can get.
Interviewer: Which ones were you not getting?
Girl: That one right there [DNA]. And I'm trying to find out this [radioactivity]
(Three Girls, 13 and 14)

Not difficult

Interviewer: I'm fascinated because you really seemed to understand the DNA experiment. Had you done something like that before?
Girl: Currently I'm at Cobb Middle School in the magnet program and we're currently learning about DNA molecules, so it's actually something we're learning about and it's cool.
(Girl, 12)

CIRCUITS

What lights depend on

Respondent: I really like the electricity thing because now they see how the lights don't just turn out, that there are wires there that makes the lights turn on.
(Teacher of first-grade class)

Interviewer: Did you have that happen with any of the things you did in here?
Respondent: Yeah, the circuits… just putting two wires together and seeing what happens.
Respondent: I think the circuit thing too because it depends on these two little wires connecting these other wires if the light bulb is going to click on.
(Girl, 12)

Maintenance problems

Interviewer: What table experiments did you do?
Girl: I did one of the tables with the electric circuits and things I had to get this electric motor to work. It was kind of hard because someone had already tried to make the wire and so they had already folded it, so it was kind of hard to get it the way it is supposed to be, but after awhile I got it to work.
(Girl, 11)

Some of this we learned about in class, like series and parallel circuits. So for that one I was just able to go, "that's how it should go," but something wasn't working right.
(Girl, 12)

Boy: The circuit one was kind of hard.
Respondent: The light bulb didn't work on one of them.
(Boy, 6)

ROCKS

Learning

Interviewer: You did one of the activities?
Respondent: I looked at the rocks.
Interviewer: What did you think?
Respondent: I told my mom that one of them was used in the watches, a quartz.
(Boy, 11)

IQ TEST

Different outlooks

Interviewer: What was your favorite?
Boy: The testing thing. [IQ] It's like, "how do you think." It's completing the puzzle.
Interviewer: Did you do this easily?
Boy: It said that there isn't really a right or wrong answer.
.....
Interviewer: what's the point of this puzzle?
Girl: Perspective. [i.e., seeing how things were different then]
(Boy, 8, and girl, 11)

Interviewer: Did you have trouble figuring it out?
Girl: No, I just kind of did it.
Girl2: I don't understand what it means if you didn't put it exactly as they had it.
Girl3: I was looking through the [historical] book.
Interviewer: Do you think this was a fair IQ test?
Girl: Yes.
Interviewer: Do you see any reason why it might not be fair?
Girl: Yes. sometimes people have different outlooks on things.
Girl2: I thought it was fun. I like puzzles and stuff.
(Four Girls, 15)

LASER TABLE

Laser light and white light

Observer's Note: The room (and the museum in general with spring break) was full and busy; the laser table was almost always in use. In general, the kids seemed engaged. Often parents led by reading the directions aloud. It did not take long (5 minutes) to complete the Laser table activities and turnover was fairly constant, sometimes with the next group standing behind and reading directions while they waited.

Girl2: We did the lasers and learned how they reacted to certain things.
(Girl, 11)

Interviewer: I saw you using the Laser station. Was this pretty easy to follow and understand or did you think it was confusing?
Girl: For me it was pretty easy because earlier in the year in my science class at school we'd done a little bit about this, so it was easy for me to follow and I knew the basic things, but I don't know about her 'cause she's younger than me, so… [to sister] Did you get it?
Girl2: No
….
Interviewer: Did you learn anything from this laser station?
Girl: Yeah. I learned that if you were to do white light to the moon, then it would fade away because it keeps spreading out so that eventually it would go away. So, I learned that.
(Girls, 10 and 8)

DISTANCE TO THE MOON

Maintenance

Interviewer: Which is your favorite?
Boy: The laser one looked interesting.
Girl: But I couldn't get the light on the back. I think it's turned off or something. I couldn't find the red dot.
Interviewer: You're right. It's disappeared.
(Boy, 8, and girl, 11)

PUZZLES

Challenging the mind

Boy: I did it! [all this time the boy has been working on the wooden puzzle, the one inside the tray]
Interviewer: How did you do it? Was it by accident?
Boy: I was thinking of the different shapes that I could make connections that would fit inside this. When I thought of this one I thought it would fit perfectly here. And then I put the triangle here for some reason.
Interviewer: Could you prove or disprove that there is only one way to do that puzzle?
Girl: With this puzzle I counted all these little blocks that are glued together to figure out what the volume was, to see if that would...
Respondent: did it help you?
Girl: No. There's 27.
Respondent: You wanted to figure out if it was a 2x2 grid, or a 4x4 grid?

Girl: Yeah.
Respondent: Is 27 the cube of anything?
Girl: That's 3 cubed, so it's 3 by 3 by 3. But then that got me confused because it said "a rectangle."
Interviewer: But you are way ahead of them.
Respondent: Good approach.
(Boy, 8, and girl, 11, and their mother)

Interviewer: What was your favorite activity in here?
Respondent: The little brainteasers over there with the blocks… [wood puzzles]
Respondent: Yeah, those things
Interviewer: Why was that your favorite?
Respondent: Because it really challenged my mind.
Respondent: It was hard
(Girl, 14)

RADIOACTIVITY TABLE

With the radiation experiment, I showed my daughter how to do the different kinds of shields to block out the radiation, so we interacted somewhat on that.
(Parent of girl, 9)

Girl: I liked the geiger counter.
Interviewer: What did you like about it?
Girl: It's something I've read about and to actually see it work. That there are actually little invisible things running around.
(Girl, 11)

Interviewer: How about this radioactivity…. Was this activity clear or was it confusing?
Girl: It was clear to me because my dad helped me out and it really works.
(Girl, 9)

Interviewer: What was your favorite thing in here?
Girl: I like the radioactivity.
Girl2: Yeah, so did I. I liked using the stuff, the tools, and everything like that; it was pretty cool.
(Girls, 14)

STEREOISOMERS

A higher level

Interviewer: Was [polio] your favorite thing or was there something else that you liked the most?
Girl: I really liked the mint experiment… the spearmint… I forget what it's called.
Mother: molecular pairs.
Interviewer: Why did you like that one?
Respondent: It's really fun. I've done it every time I've come here and it's really fun.
(Girl, 10)

Interviewer: What about this experiment that you two are working on, the mint experiment?
R1: I thought it was pretty good. It is good because it is really hands-on and may seem elementary at first but the reading and the background that makes the science go along with it is definitely upper level, and so I think it is a good way to have upper level information that draws on the hands-on activity.
R2: I agree, but I think our kids, if they were to come in here alone, would sit down and rush through it; they wouldn't do the reading at all. That's what you're dealing with any time you're dealing with kids.
(Middle-school teachers)

STILL

Boy: I've been through these things hanging on the wall, the CO2 analyzer and the still. I didn't look at those much.
(Boy, 8)

Respondent: I don't really have a favorite, I just like to do this stuff and next I'm probably going to go look at what is a still.
(Girl, 11)

Suggestions

Log or journal

At school we have Vanderbilt students come to help us do experiments, like the ones here. And we actually do use our hands, and we do have to take notes to present and to remind us of what we did for that day.
(Boy, 13)

She's got a very good scientific mind. She's always writing notes down, keeping track of

things. I've always told her she'd be a good a scientist. In fact, when I grew up, women were not encouraged to be scientists.
(Grandmother of girl, 10)

Interviewer: What kind of follow-up would you like?
Respondent: Yes! I would love to see them have a piece of paper where they would make a prediction of what they were going to find beforehand. You get them thinking of the word hypothesis that way. Forming an hypothesis and then testing it. That is very different for students to wrap their heads around. When kids in middle school think of experiments they want to copy something that's been done. Over and over again in the lab they will erase their hypothesis and re-write it because they got a different answer. That just had to be drummed in them that the hypothesis is a guess and you'll prove it right or wrong, but both are useful.

Interviewer: So you think the kids should have a log?
Respondent: Yes, a worksheet. Have a title. What did they add? It would work for 4th grade up. For 3rd grade down, I don't know. I don't have enough experience with that age.
….
Respondent: He is in third grade and he could have used a worksheet with leading questions.
Interviewer: What do you think about that, guys? Would you have liked to have a real, scientific notebook to work with, to record these things.
Girl: We have one. We do things online.
Interviewer: Do you like that? Does it make it better or is it just more work?
Girl: I like illustrating the set up of the experiments.
Boy: I like how you can look back and see what you did.
Interviewer: Have you thought about writing up today's experiment?
Boy: Yeah.
(Boy, 8, and girl, 11, and their mother)

Interviewer: Are you going to tell them about this [when you go back home]?
Girl: Uh-huh. I'm supposed to make a powerpoint report when I get back.
(Girl, 11)

Activities relating to the body

Interviewer: What would make the center better?
Girl: Last year in school we studied the human body system, and made a lung. You took the top of a [two liter] bottle, you cut it and taped a balloon to the lid, and you stuck the balloon in and then you taped a plastic wrap around the bottom, and you pulled it, and the lung would inflate, it was like the diaphragm, how it works, and you would pull and it would inflate and you push and it expels. That was fun. It was fun to imagine it.

(Girl, 11)

Activities you could do at HOSC and then take home

Boy: I would like things you could do here and then take them home, and do them any time you wanted to by using simple things, and not have to go to lots of different craft stores.
(Boy, 12)

More activities

Interviewer: What would you do to make this a better place for you?
Boy: Well, I would add a few more science stuff cause sometimes this place can get really crowded and if you want to learn as much as you can there might not be enough room to learn it all, so that's what I would do.
(Boy, 11)

Fingerprinting

Interviewer: Tell me what you think would make it a better center.
Girl: Like fingerprinting and stuff for DNA testing would be kind of cool. To make your own fingerprints and test that all…
(Girl, 13)

More colors

Interviewer: Anything you would suggest to improve this science center?
Respondent: It's pretty good so far. Maybe just to make it a little more noticeable, add some different colors if that's allowed. It's kind of bland. The only thing colorful is that sign up there and the little test tubes and stuff.
(Parent of girl, 12)

Easier-to-read instructions

Interviewer: Any suggestions about what would make this a better place for kids?
Girl: Maybe just put the wording a bit easier for younger children because I'm ten; I'm

probably one of the oldest ones who've done this, and it was a bit hard for me, but it was easier because I was reading it and I could see the words around it.
(Girl, 10)

Appendix D: Survey Findings

AGE

"How old are you?"

Age	Percent
5 to 8	24
9 to 12	32
13 to 17	14
18 to 34	8
35 to 45	15
over 45	7
Total	**100**

Average age under 21	10
Average age 21 and over	41

SEX

"What sex are you?"

Response	Percent
Girl	55
Boy	45
Total	**100**

RESIDENCE

"Do you live in Washington, Virginia, or Maryland?"

Response	Percent
Yes	74
No	26
Total	**100**

VISIT GROUP

"Who are you in the museum with?"

Response	Percent
School group	4
Friends	5
Family	88
I'm alone	3
Total	**100**

INFORMATION SOURCE

"How did you know about the Hands On Science Center?"

Response	Percent
Been here before	10
Saw it	69
Heard about it	16
Internet	5
Total	**100**

LENGTH OF STAY

"How long were you in the Hands On Science Center?"

Response	Percent
Less than 15 minutes	26
15 to 30 minutes	34
30 minutes to 1 hour	31
1 hour to 2 hours	7
More than 2 hours	2
Total	**100**

USE OF TABLES

"Which of these (tables) did you do today?"

Table	Percent
Circuits	50
Radioactivity	39
Puzzles	37
Laser	34
DNA	24
Rocks and fossils	19
Moon distance	16
IQ	13
Stereoisomers	11
No tables	18

NUMBER OF TABLES BY AGE

	Percents			
Number	Age 5-12	Age 13-17	Age 18+	**All visitors**
None	16	11	22	18
One	20	30	22	23
Two	18	16	20	18
Three	15	14	20	17
Four	12	13	8	11
Five	4	6	3	4
Six	7	5	1	5
Seven or more	8	5	4	4
Total	100	100	100	100

Average number of tables per visitor 2.4

USE OF EXPERIMENTS

"Which of these (experiments) did you do today?"

Experiment	Percent
Carbon dioxide	16
Food additives	13
Polio	12
DNA	8
Star-Spangled Banner	5
Water pollution	4
Lasers	2
Paving stones	1
No experiments	49

NUMBER OF EXPERIMENTS BY AGE

	Percents			
Number	Age 5-12	Age 13-17	Age 18+	All visitors
None	42	61	57	49
One	50	28	38	43
Two	8	9	5	7
Three or more	0	2	0	1
Total	100	100	100	100

Average number of experiments per visitor 0.6

RATING

"How much did you like the Hands On Science Center Today?"

Response	Percent
One ("Didn't like it")	1
Two	1
Three	3
Four	1
Five ("It's ok")	7
Six	11
Seven	10
Eight	17
Nine	15
Ten ("Loved it")	34
Total	**100**

Average rating 8

RATING SCALE EQUIVALENT

Scale	Percent
Poor (1-2)	2
Fair (2-4)	4
Good (5-6)	18
Excellent (7-9)	42
Superior (10)	34
Total	**100**

THREE EXPERIMENTS WERE STRONGLY ASSOCIATED WITH HIGH RATINGS

	Percents			
Experiment	Scored 1-6	Scored 7-9	Scored 10	**Total**
Carbon Dioxide	4	35	61	100
Polio	3	50	47	100
Food additives	13	32	55	100

THE YOUNGEST WERE MOST PLEASED; TEENS WERE LEAST PLEASED

	Percents			
Age	Scored 1-6	Scored 7-9	Scored 10	**Total**
5 to 8	21	24	55	100
9 to 12	26	45	29	100
13 to 17	38	46	16	100
18 to 34	24	41	35	100
35 to 45	11	53	36	100
over 45	22	50	28	100

DOING NO EXPERIMENTS WAS STRONGLY ASSOCIATED WITH LOW RATINGS

	Percents			
Number of experiments	Scored 1-6	Scored 7-9	Scored 10	**Total**
None	37	44	19	100
One	12	40	48	100
Two or more	8	38	54	100

YOUNGER CHILDREN WERE MORE DRAWN TO CIRCUITS AND TO ROCKS AND FOSSILS

	Percents			
Table	Age 5-12	Age 13-17	Age 18+	**Total**
Circuits	64	14	22	100
Rocks and Fossils	73	10	17	100
All HOSC visitors	56	14	30	100

MOST VISITORS MADE USE OF THE TABLES, WHETHER THEY DID EXPERIMENTS OR NOT

	Percents		
Combination	Age 5-12	Age 13-17	Age 18+
No experiments, no tables	5	5	15
No experiments, 1 table	7	19	11
No experiments, 2 tables	10	8	11
No experiments, 3 tables	9	11	13
No experiments, 4 tables	4	11	4
One experiment, no tables	11	6	7
One experiment, 1 table	10	8	11
One experiment, 2 tables	7	5	8
One experiment, 3 tables	5	3	6
One experiment, 4 tables	7	0	3
Other combinations	25	24	11
Total	100	100	100