Traveling Experiment Gallery

Final Evaluation Report

Eric D. Gyllenhaal, Ph.D.
Selinda Research Associates

September1998

EXECUTIVE SUMMARY

This report summarizes the evaluation of the first 20 months of the National Science Foundation-funded tour of the *Traveling Experiment Gallery*. The *Traveling Experiment Gallery* is the touring version of Science Museum of Minnesota's successful core science hall, the *Experiment Gallery*. The evaluation of the *Traveling Experiment Gallery* was conducted using naturalistic inquiry methodology. Depth interviews were conducted with 28 staff and six volunteers at the five museums and science centers which have hosted the exhibition. The evaluators also spent almost 30 hours observing visitors, floor personnel, and visitor-staff interactions within the exhibition, and conducted depth interviews with 16 visitor groups, which included 32 individual visitors. In all, there was approximately 110 hours of data collection. The two major threads of the evaluation, the host museum staff experience and the visitor experience, were woven together to produce this report. The primary findings are summarized below.

- ***Overview:*** It appeared that the *Traveling Experiment Gallery* was a successful exhibition, filling an important niche at each of the host institutions.

- ***Staff reactions:*** Staff at the host institutions talked about almost all aspects of the *Traveling Experiment Gallery* in extremely positive terms. Respondents spoke very highly of the levels and types of interactivity in the exhibit, the exhibit design and use of materials, the "feel" of *Traveling Experiment Gallery*, and the support provided by Science Museum of Minnesota staff.

- ***Visitor Experience:*** On the whole, the visitor experience also seemed very positive. The exhibit seemed to appeal to a broad range of visitors, but it seemed to work particularly well for children from about fifth grade and up. Many adults also seemed to become engaged with their children or on their own. Groups with younger children appeared to have a harder time finding appropriate activities.

  There were many indications that the range of visitor experiences in the *Traveling Experiment Gallery* paralleled the range of experiences that visitors had in the original *Experiment Gallery* at the Science Museum of Minnesota. The *Traveling Experiment Gallery* appeared to be providing in-depth and meaningful experiences for many visitors. These experiences seemed to be even deeper and more meaningful when skilled floor staff and volunteers were able to guide a visitors' interactions with the exhibits.

- ***Initial Expectations:*** The promotional materials helped create many of the initial expectations in the host institutions and helped them to prepare for the experience to come. The first version of these materials appeared to be only moderately successful at this role. Science Museum of Minnesota has both improved the materials and initiated a series of phone conversations between host staff and Science Museum staff several months prior to the installation of the exhibit.

- ***Exhibit Fee:*** Many respondents remarked at the relatively low fee charged for the *Traveling Experiment Gallery*. Most full-time exhibits and administrative staff seemed to be aware that the exhibit fee was subsidized by the National Science Foundation.

- ***Exhibit Space and Configuration:*** The *Traveling Experiment Gallery* appeared to work well in exhibit spaces ranging from 1,200 square feet to almost 5,000 square feet, although there were problems with both extremely large and extremely small spaces.

The *Activity Station* seemed to be most effective when it was prominently visible as visitors entered the gallery.

- ***Exhibit Maintenance:*** In the eyes of host museum staff, exhibit maintenance has not been a major problem in this exhibition. According to many host staff, the Science Museum of Minnesota provided them with the best support they have ever experienced for a traveling exhibit. This report makes an initial attempt to define best practice in providing support for traveling exhibitions based on hosts' reactions to the support provided for the *Traveling Experiment Gallery*.

- ***Daily Upkeep:*** There were no indications that the daily upkeep of the interactives was creating major problems for the host staff. In fact, some respondents told us that daily upkeep was relatively easy and not as much work as they had expected.

- ***Staffing the Exhibition:*** The *Traveling Experiment Gallery*, by design, was a staff intensive exhibition. There were indications that recruiting and maintaining appropriate levels of paid and volunteer staffing were difficult for both small and medium-sized museums. However, respondents agreed that floor staff and volunteers played an extremely important role in the visitor experience, and that staffing the exhibition was well worth the effort and expense.

- ***Training Floor Personnel:*** The most successful approach to training of floor personnel seemed to involve separate training sessions for staff and volunteers by Science Museum of Minnesota trainers, followed by continuing on-the-job training by the staff who supervised the volunteers.

- ***Activity Station:*** There were many indications that the *Activity Station* was extremely popular with both staff and visitors, and that this section played a critical role in the visitor experience, especially for younger children and their families.

- ***Resource Area:*** The *Resource Area* appeared to play several important roles in the exhibition, including serving as a resting area for parents, an activity area for pre-school children, a training resource for floor personnel, and a reference library for visitors.

- ***Safety:*** Although many respondents expressed initial concerns about the safety of some exhibits, *Traveling Experiment Gallery* seemed to be no more dangerous -- and quite possibly less dangerous -- than other hands-on science exhibits. Staff concerns were alleviated by seeing the exhibit in action at another host institution, learning about the safety mechanisms incorporated in the exhibits, and/or seeing the exhibit in action at their own institution.

- ***School Groups:*** There were many indications that school visits were an important aspect of the *Traveling Experiment Gallery* tour. The Science Museum of Minnesota should consider ways in which they can support the use of the exhibition by guided school groups.

- ***Interactions Between Floor Staff and Visitors:*** Working within the inquiry-based philosophy of the *Traveling Experiment Gallery*, floor staff and volunteers were encouraged during training to act as lab assistants and mentors for visitors, rather than as traditional docents or demonstrators. There were indications that most staff and volunteers tried to engage at least some visitors in inquiry-based learning, although most also regarded giving explanations as an important part of their role. We saw a broad range of skills at guiding visitors inquiry, and we watched both skilled and unskilled

personnel succeed and fail in their interactions with visitors. This report develops a model to help understand why some interactions succeed, and some fail.

- ***Roles Within the Host Institutions:*** Most of the host institutions seemed to be growing and developing in ways that could benefit from an in-depth consideration of the philosophy and design of the *Traveling Experiment Gallery*. In some cases, respondents were quite clear that they understood the roles that *Traveling Experiment Gallery* could play in their institutional transitions, and they tried to take advantage of the opportunities presented by the exhibition. For example, at various host institutions the exhibition played a role in:
  - Educating staff from a range of departments about inquiry-based and open-ended exhibits and programs.
  - Allowing museum educators to try out, set the direction for, and train volunteers and staff for a new inquiry-based approach to their gallery programming.
  - Educating exhibits staff about the design and maintenance of exhibitions with large numbers of physical science interactives.

- ***Size and Type of the Host Institution:*** All of the issues discussed above appeared to be affected by the size and type of museum or science center that served as host institution. Some respondents from smaller institutions expressed concern that the Science Museum of Minnesota was not fully accepting of the needs and limitations of the smaller museums on the tour. There were indications that Science Museum of Minnesota staff were realizing the value of increased flexibility when dealing with these smaller institutions.

- ***The Meaning of*** **Traveling Experiment Gallery:** Many staff and volunteers seemed to find a range of personal meanings in the exhibition. Added across host institutions, the range of meanings seemed exceptionally broad -- much broader than the core principles of process of science, open-ended exhibitry, and inquiry-based learning that were discussed in the original National Science Foundation grant. In some cases, respondents' personal meanings may have interfered with their understanding of the three core principles of the exhibition, but for other respondents the range of alternative meanings seemed to enrich their understanding of the *Traveling Experiment Gallery*.

- ***Recommendations:*** Specific recommendations are included.

TABLE OF CONTENTS

INTRODUCTION

The following report summarizes the evaluation of the first 20 months of an on-going National Science Foundation-funded tour of the *Traveling Experiment Gallery*.

The *Traveling Experiment Gallery* is the touring version of Science Museum of Minnesota's successful core science hall, the *Experiment Gallery*, which also was funded in part by the National Science Foundation. The *Experiment Gallery* contains more than 50 interactive exhibits, each developed through a process of extensive prototyping and visitor testing. Many of the exhibits were designed to involve visitors in observing and experimenting with natural phenomena, giving visitors control over the experimental set-up and a range of variables. One of the chief goals of the project was to help spread the concept of this sort of open-ended exhibit to smaller museums and science centers.

Although this project continues to operate, in accordance with established research standards, this report was written in the past tense to ensure clear and unambiguous communication.

About the Exhibition

The developers of the *Traveling Experiment Gallery* have said that the best way to learn science is to experience scientific methods first hand. Thus, the exhibits and programs that they developed focused on the ***process*** of scientific exploration, rather than on demonstrations of flashy phenomena or descriptions of pre-digested scientific principles. In the exhibition, visitors were encouraged to mess around with and observe physical phenomena, ask questions about them, and then design experiments to try to answer their questions. Many of the exhibits and activities were ***open-ended:*** They supplied a variety of materials that visitors could use in different ways to produce a range of different outcomes. In the *Traveling Experiment Gallery*, both the labels and interactions with staff and volunteers were intended to be ***inquiry-based***, meeting visitors questions with more focused questions and suggestions for experiments. In the end, it was hoped that visitors could learn to ask better questions on their own and to find their own answers.

The *Traveling Experiment Gallery* included 26 components, which could be classified into four very different types of exhibit elements:

- **Experiment Benches**, areas for open-ended science explorations, which had equipment and directions for many experiments on a given topic.
- More traditional **Interactive Science Exhibits**, which generally had a more limited range of possibilities, but may still produce a range of outcomes
- The staff- and volunteer-operated **Activity Station**, where visitors could conduct a series of experiments with the help of "science mentors"
- The **Resource Area**, a partially enclosed living-room like area where visitors could explore science books, audio-visual materials, science games, and other informal materials

The benches and more "traditional" interactive components covered seven general areas: electricity, light and optics, mechanics, oscillators and resonance, pendulums, waves, and weather. The Science Museum of Minnesota encouraged host institutions to have staff and volunteers roving through these exhibits, helping visitors use the exhibits and engaging them in inquiry-based dialogues.

Science Museum of Minnesota's touring exhibits program has been active since 1983. At the time of this study, they were traveling four shows: the *Traveling Experiment Gallery*, *Hunters of the Sky* (about birds of prey), *Antarctica*, and *Bears: Imagination and Reality*.

The materials that promoted the *Traveling Experiment Gallery* stated that it was created for small- and medium-sized museums and recommended an exhibit area of approximately 2,500 square feet and a rental period of typically 15 weeks. The cost to the host institution was listed as $17,500. These promotional materials also stated that supplemental materials and training materials would be provided, including teacher's and activity guides, press materials, and training for both technical and program staff.

According to Science Museum of Minnesota's Touring Exhibit Service staff, institutions that expressed an interest in and eventually contracted for the exhibition received a variety of other support materials and information, including more detailed information about the exhibit components and requirements for staffing. Science Museum of Minnesota staff stressed to us that these support materials would continue to evolve as the *Traveling Experiment Gallery* tour continued and the needs of host institutions were better understood. Indeed, another draft of these materials was completed during the time period of our study.

Science Museum of Minnesota staff traveled to each site to handle set-up duties and to train host museum staff in routine maintenance functions. They also left a variety of replacement parts with the host institutions and provided phone numbers to call whenever extra help was needed.

The *Activity Station* allowed visitors to engage in a variety of "messy" activities with staff and volunteers as guides and co-explorers. The chemistry activities were generally too wet, too cold, or too hot to be included in more conventional exhibits. Chemistry activities included experiments with acids and bases, carbon dioxide (e.g., "dry ice"), and paper chromatography. The physics activities tended to have lots of parts that could be assembled in different ways (like electric motors) or things that could break (like resonating wine glasses and sea shells). Physics activities included experiments with electric motors, resonance, and weather phenomena.

Host program staff and volunteers received training both in how to do the *Activity Station* experiments and in how to engage visitors in inquiry-style interactions. The Science Museum of Minnesota sent a staff person to the host institution for several days prior to opening of the exhibition to complete this training and again provided a phone number to contact about any problems or questions. The Science Museum of Minnesota also published and provided to host institutions a 173-page guide to the *Activity Station*, entitled *Let's Try It...And See What Happens!* This guide explained the philosophy behind the *Activity Station* and then stepped through a variety of experiences and experiments that could be done at the *Activity Station*.

In addition to pre-opening staff training, the Science Museum of Minnesota supplied host museums with a 24-page "Experiment Gallery Exhibit Guide," which was designed to help school teachers plan class visits to the *Traveling Experiment Gallery*. This guide listed all of the Experiment Benches and interactive exhibits, described seven of the benches and exhibits in detail, and discussed the main science concepts dealt with in five of the exhibit clusters.

METHODOLOGY AND METHODS

The evaluation of the *Traveling Experiment Gallery* was conducted using *naturalistic inquiry methodology*. Relying heavily on depth interviews with participants, this research results in rich and descriptive narrative data in participants' own words. Depth interviews were open-ended and relied on an informal conversational interviewing style. The interviews were based on a protocol adapted to each site, which reflected the issues laid out in the topical framework developed for this study (Appendix A). The strength of this type of methodology is that it allows us to gain a deeper understanding of the participants experience in their own terms, allowing issues to emerge that are not anticipated in advance.

Naturalistic methodology describes a wide range of participant experiences rather than an "average" or "typical" experience. Our analysis begins with the assumption that there is truth in everything that people tell us, but there is no single "Truth" that holds across the entire range of experiences. We should *expect* to find many different versions of what happened. These versions can vary because each participant experiences different events, but also because each participant brings a unique perspective to their experience. Naturalistic inquiry attempts to describe and to understand both the experiences and the world views that are encountered. In some cases, we may be able to reconcile conflicting stories about the events that took place; in other cases, such reconciliation will not be possible or even desirable.

The evaluation team consisted of an outside evaluator (Deborah Perry) and one of her associates (Eric Gyllenhaal). Both team members participated in project management, data collection, and data analysis. A summary of the data collected for this project is attached as Appendix B.

The Research Questions

This evaluation study had two threads: the Host Museum Staff Experience, and the Visitor Experience. Most of the questions that we tried to answer evolved from the Topical Framework developed early in the project (Appendix A).

The Host Museum Staff Experience Thread began with an investigation of the host institutions themselves. What was their size, operating budget, and visitorship? How were they organized, and what were the roles of the departments relative to temporary exhibitions? What was their previous experience with traveling exhibitions? What was important to the museum's staff, and what did it feel like to work there?

We also investigated the operational issues that arose around the *Traveling Experiment Gallery*'s visit. What was the staff's experience with exhibit set-up and maintenance, especially in regard to Science Museum of Minnesota's support functions? How did the institution handle staffing of the exhibition, and what was their experience with staff and volunteer training? What was it like to work in *Traveling Experiment Gallery* at that site?

Finally, we explored staff perceptions of the exhibition. In what ways did staff think about the process-oriented, open-ended, inquiry-based approach of the exhibition and related programming? What were staff perceptions about the visitor experience in *Traveling Experiment Gallery*? What did staff have to say about the overall success of the exhibition, and of its individual elements? What lessons did staff take away from their experiences

with *Traveling Experiment Gallery*, and what changes were they contemplating within their own institutions based on these lessons?

In many ways the research questions for the Visitor Experience Thread paralleled those for any other summative evaluation. We worked to develop a better understanding of a) what feelings, concepts, thoughts visitors were taking away with them, b) how visitors interacted with gallery staff and with other members of their social group, and c) how visitors physically interacted with the various units and with related phenomena such as the design and layout of the exhibit elements. We also followed up on visitor-related issues that were raised by host staff, and we tried to compare our observations and perceptions of the visitor experience with the perceptions that we have heard from the host museum staff. Finally, we looked for ways in which the visitor experience varied from one host institution to the next.

This report focuses on the *range of issues* raised as we investigated the Host Museum Staff Experience and the Visitor Experience Threads. The narrative weaves together the staff and visitor threads to present a cross-institutional analysis of the major themes that emerged during the study. We hope this approach has helped us cut across the boundaries between the sites and perhaps to find out about some more general lessons being learned by Science Museum of Minnesota, the host institutions, and the evaluation team. In the end, we hope that our findings and analysis will help the Science Museum of Minnesota to better serve its *wide range* of host institutions, and to better achieve its educational goals with its *varied* audiences.

HOST INSTITUTIONS AND RESPONDENTS

The personnel we talked with at host institutions often included full-time staff who were responsible for temporary exhibitions, exhibit maintenance, gallery programs, and evaluation; part-time staff who worked on the floor in *Traveling Experiment Gallery*; volunteers who worked in the exhibition; and, in some cases, museum staff who were not directly associated with the exhibition, but who had been visiting, reacting to, and learning from *Traveling Experiment Gallery*.

Science Place

The first host institution was Science Place, a medium-sized science and health museum in Dallas, Texas. The *Traveling Experiment Gallery* was there from late September, 1996, through early January, 1997.

Respondents described Science Place as hands-on, rather than collections-based, and said that the museum had no research staff. They told us that paid attendance was in the range of a half million visitors per year. The Science Place building was on the Texas State Fairgrounds, and they were free during the month of the State Fair (late September to late October), when they attracted 150,000-300,000 visitors. *Traveling Experiment Gallery* was very heavily used during the month of the State Fair. Respondents also told us that Science Place served more than 100,000 school children annually.

Permanent exhibitions at Science Place included physical science, health and medicine, a children's area, and a small area dedicated to dinosaurs. Many of these exhibits had been built by contractors, rather than in-house. The permanent hands-on physics exhibits seemed to be very popular with Science Place visitors.

Respondents told us that Science Place had a long tradition of conducting gallery programs for the public. Floor staff included a floor staff manager, three full-time floor staff (including a college intern), and two part-time floor staff on weekends. The 50 to 75 Education Department volunteers also participated in gallery programs. Although Science Place once had a *Youth Alive* program, teens and adults were now included in the same volunteer program. The floor staff and volunteers apparently worked all over the museum, operating gallery activities from a mobile cart for each permanent exhibit space and staffing exhibit components that require a volunteer to operate them. Respondents told us that *Traveling Experiment Gallery* arrived at Science Place during an interval when it was both expanding its use of floor staff and shifting towards an emphasis on Socratic dialogues with visitors rather than more tradition demonstrations of science phenomena and principles.

Science Place hosted four traveling exhibits each year. The *Traveling Experiment Gallery* installation squeezed 25 components into an L-shaped temporary exhibit hall that was relatively small (1,100 to 1,200 square feet). The *Activity Station* was adjacent to and facing one of the two entrances to the exhibit hall.

Apparently the *Traveling Experiment Gallery* was staffed during most open hours. Staffing levels seemed to be particularly high during the State Fair, when up to three staff and five volunteers were in the exhibit at a time. Respondents told us that the recruitment and training of staff was complicated by personnel changes just prior to the exhibit opening. Volunteers were trained separately from staff, and staff training time seemed to be minimal Apparently about two-thirds of the *Traveling Experiment Gallery* volunteers were teenagers.

Although there was no formal evaluation of the *Traveling Experiment Gallery* at Science Place, a student from the Department of Museum Studies at Baylor University tested an evaluation instrument for two days during the State Fair, as part of a research seminar at the university (Faulkner, 1997).

We conducted phone interviews with Jeff Courtman, Vice President of Exhibits, and Paul Vinson, Director of Public Programs.

Heritage-Hjemkomst Interpretive Center

The second venue in this study was the Heritage-Hjemkomst Interpretive Center in Moorhead, Minnesota. The *Traveling Experiment Gallery* was installed from late January through early May, 1997.

Respondents described Heritage-Hjemkomst as a small museum with an interdisciplinary mission to interpret the arts, sciences, and humanities for the large but thinly populated Red River Valley in Minnesota and North Dakota. Attendance at the Center varied from 30,000 to 100,000 visitors per year, depending in large part on the traveling exhibits scheduled that year. (The highest annual attendance coincided with a dinosaur exhibit.) The interpretive center was staffed by a few full-time and seasonal employees, several part-time janitorial and maintenance staff, and 35 to 40 volunteers. As with many small museums, the individual staff members seemed to find themselves with a broad range of responsibilities. For instance, the Curator/Exhibitor's responsibilities included, among other things, caring for the Hjemkomst collection (about 1000 pieces), coordinating traveling exhibits, building permanent exhibits, conducting school and public programs, and editing an historical newsletter.

The ten-year-old interpretive center was housed in a 38,000-square-foot building owned by the city. The interpretive center's major permanent exhibit was a Viking ship that was built in Minnesota and then sailed to Norway. The building also housed the Clay County Museum, which has collections and exhibitions related to Clay County history.

Respondents told us that the Heritage-Hjemkomst organization mounted temporary and traveling exhibitions in the Heritage Hall. Although some temporary exhibitions were produced in-house, most were traveling exhibitions. Exhibitions changed three times each year, and they included art, science, and history themes, as well as interdisciplinary combinations of art and science. Respondents said there were often two or more exhibitions in Heritage Hall focused on similar themes. For instance, there was a small exhibition on bison mounted along side *Traveling Experiment Gallery* as part of a science theme. *Traveling Experiment Gallery* occupied more than 4000 square feet of 7000-square-foot Heritage Hall.

Respondents told us that staffing *Traveling Experiment Gallery* was difficult. They did not hire temporary staff to operate the *Traveling Experiment Gallery*, and they had difficulty recruiting volunteers for the exhibit. Apparently the training sessions with Science Museum staff were basically one-on-one with interpretive center staff. Respondents told us that, subsequent to this training, the Curator-Educator recruited and trained seven college science students to serve as volunteer docents on weekends. These students wanted to be science teachers and were seeking experience with children.

The installation of *Traveling Experiment Gallery* at Heritage-Hjemkomst coincided with major blizzards and record-setting floods that kept visitation to a minimum. Although the interpretive center building was located close to the river, it was on higher ground.

Respondents told us that the flood waters reached the back door and blocked an access road, but did not make it into the building.

We conducted phone interviews with Beverly Woodward, Executive Director, and Pete Conlin, Curator/Exhibitor.

Denver Museum of Natural History

The third venue was the Denver Museum of Natural History in Denver, Colorado. The *Traveling Experiment Gallery* was in Denver from late May through August, 1997.

Historically, the Denver Museum of Natural History has been a classic collections and research-oriented natural history museum. Permanent exhibitions have included dioramas of natural habitats and wildlife, displays of spectacular minerals, and paleontology halls with mounted dinosaur and mammal skeletons. Over the last decade many of these classic exhibitions have been revamped and remounted. Also over the last decade, Denver Museum of Natural History has been developing an increasingly broad mission as the major science museum in Colorado. As our respondents explained it, the museum's mission was broadening because that there were no other major science-oriented museums in the city of Denver. The museum had begun mounting exhibitions that, in cities with multiple science museums, might be found at a science or health museum or planetarium. For instance, the museum had added the permanent Hall of Life exhibition on human biology and an IMAX theater. Recent temporary exhibitions on a science and technology theme had included *Science of Sports* from COSI, and *Flight: Where Adventures Take Off* from the Children's Museum of Indianapolis was scheduled to open in October, 1998. The major permanent exhibition being planned during the summer of 1997 was termed the "Space Science Initiative," which was described as a mix of new facilities, exhibitions, and programs.

Some respondents told us that they or other staff members at the museum had some reservations about this broadening mission. The *Traveling Experiment Gallery* apparently became a major focus for staff discussions about their reactions to their changing institution, especially during the internal staff conference described later in this section.

Respondents described the Denver Museum of Natural History as a large museum -- larger than the small to medium-sized institutions targeted by the National Science Foundation grant. Apparently Denver had been recruited as the summer, 1997, venue when the original host scheduled for that time canceled. One of the problems that Denver faced was the fact that *Traveling Experiment Gallery* was a last-minute addition to their exhibition schedule. Another problem cropped up a few months before opening, when a major international conference was scheduled for the space where the exhibition was eventually mounted. When the space for *Traveling Experiment Gallery* finally was confirmed, Denver and Science Museum of Minnesota staff had to work quickly to finalize the arrangements for the exhibition.

Traveling Experiment Gallery was installed in the Denver Museum of Natural History's Jaguar Gallery on the second floor, where it had ample space (almost 5000 square feet). The *Activity Station* was visible to visitors as they entered the exhibition, although it did not directly face the entrance.

Respondents told us that Denver Museum of Natural History often mounts large temporary exhibitions in the spring and fall to drive attendance. However, because the summer tourist trade keeps attendance levels high, the museum generally does not mount or advertise traveling shows during the summer months In part because of this tradition, *Traveling Experiment Gallery* was marketed to museum members but received very little other

publicity to the general public. Respondents told us that the museum developed a variety of methods to market *Traveling Experiment Gallery* within the museum building, including signage, recommendations from staff at the museum's entrance, and murals along the entrance hallway. According to an in-house survey of visitors to *Traveling Experiment Gallery*, the largest categories of visitors were (a) tourists and (b) museum members and other frequent visitors to the museum. Respondents described this as a typical summer audience for the Denver museum.

Denver's size seemed to be a major asset as they arranged for staffing the exhibition. They were able to muster a range of staff and volunteer resources for *Traveling Experiment Gallery*. The museum hired four temporary staff to work as Team Leaders in the *Traveling Experiment Gallery* on a rotating basis, covering both weekdays and weekends. They also recruited a relatively large force of volunteers for the *Traveling Experiment Gallery*, including both adults and teenage volunteers. As a result, staffing usually exceeded the minimum requirements laid out in the Science Museum of Minnesota's contract. Our respondents told us that, during open hours there were always at least two people scheduled to on the floor, a staff member and at least one volunteer, and often several volunteers were available in the exhibit. In addition to temporary staff and volunteers, we were told that the *Experiment Gallery* was often staffed with a security person. In many ways, the staffing situation at Denver gave us a chance to see what can happen in a "best case" scenario for staffing the *Traveling Experiment Gallery*.

The four temporary staff, referred to as Team Leaders, seemed to be well qualified for their positions. They included two school science teachers who had used inquiry in their classrooms and two college students who had volunteered in the Denver Museum of Natural History's teen volunteer program during their high school years. The Team Leaders told us that they had a range of responsibilities. They said that they interacted with visitors, handled much of the daily upkeep in the exhibit, coordinated the activities of the volunteers, and, when necessary, took care of crowd control and behavior problems among visitors. The more routine aspects of their jobs -- upkeep and maintenance -- seemed to consume only a small portion of their day. The Team Leaders said that this left them free to devote lots of time to visitors and to the continuing training of the adult volunteers. Respondents told us that the this continued training consisted mainly of modeling inquiry-based learning and question-answer techniques. Team Leaders were also responsible for the on-the-job training of the teen volunteers.

The Denver museum had a large pool of active adult volunteers to recruit from, many of whom had worked on the floor during previous large-scale temporary exhibitions. Drawing mainly from this volunteer pool, the museum was able to attract more than enough adult volunteers for the *Traveling Experiment Gallery*. Respondents told us that the Gallery Programs Manager used interviews and other screening techniques to help select volunteers who (a) seemed comfortable with -- and even committed to -- using inquiry techniques; (b) would enjoy working with visitors in a setting that was less structured than some previous exhibitions; and (c) were often knowledgeable about the content of the exhibit. The adult volunteers had a range of backgrounds, some in education, science, or engineering, and some in other fields. The volunteers who we talked with included two school science teachers, an engineer, and a postal service employee who had been volunteering at the museum for six years.

Our respondents described three phases of training for adult floor personnel at Denver: (a) the staff training, run by Science Museum of Minnesota staff; (b) the adult volunteer training, led by Science Museum of Minnesota and Denver staff; and (c) continuing informal, on-the-job mentoring and modeling by the Team Leaders.

The museum also has a teen volunteer program, and some members of this group served as floor staff for the *Traveling Experiment Gallery*. Although teen volunteers attended some of the adult volunteer training sessions, most of the training for this group seemed to consist of on-the-job training and individual supervision by Team Leaders.

Floor personnel told us that they were instructed *not* to act in the more traditional museum roles of "docent," "tour guide," or "interpreter." Rather, they were asked to behave as "science coaches," "lab assistants," and "mentors," guiding visitors through an inquiry process, rather than dispensing information. Floor personnel also said they were asked to use inquiry-based techniques to help visitors find their own answers and their own questions. Most of them said that they answered visitors' questions, whenever possible, with further questions or with hints about how visitors could answer their own questions using the experimental apparatus.

There were many indications that the Denver staff and volunteers had established what might be called a "culture of inquiry" among the floor personnel in the *Traveling Experiment Gallery*. We're calling attention to this cultural phenomenon at Denver because, as far as we could tell, it did not exist to the same degree at the other host institutions in this study. Although individual floor personnel seemed to participate in this culture to varying degrees and with varying levels of skill, all the floor personnel who we observed at least tried to engage visitors in inquiry learning, and everyone who we talked with had obviously been thinking about the pros and cons of the inquiry approach.

Although *Traveling Experiment Gallery* was installed in Denver during the summer vacation months, the exhibition was nonetheless visited by year-round schools from the Denver metropolitan area. At the time of our site visit the museum was not conducting formal school tours in the *Experiment Gallery*.

Traveling Experiment Gallery came to Denver at what appeared to be a critical stage in its evolution as an institution. Our respondents told us that 1997 had been declared a "learning year" at Denver, and the *Traveling Experiment Gallery* became the focus of an internal *Experiment Gallery* conference about the possible future roles of interactive and inquiry-based science exhibits at Denver Museum of Natural History (*The Experiment Gallery Conference Final Report*, 1997). As some respondents put it, *Traveling Experiment Gallery* served as an internal experiment for the museum. The experiment was primarily a test of how well this style of physical science exhibit worked for the staff and visitors at Denver Museum of Natural History. Some aspects of the experiment related to how well the staff performed their duties related to maintaining and staffing the exhibition, and other aspects related to how visitors reacted to the exhibit. The question of how well *Traveling Experiment Gallery* fit into Denver Museum of Natural History seemed to be critical to many of the museum's staff.

The stated purpose of the conference was to understand what features, if any, of an *Experiment Gallery*-like experience fit into the future directions of the Denver Museum of Natural History (*The Experiment Gallery Conference Final Report*, 1997). The conference goals were to:

1. Promote and encourage staff experience of a kind of exhibitry and programming not common at Denver Museum of Natural History.
2. Promote and encourage staff understanding of inquiry-based learning.
3. Promote and encourage staff discussion about learning styles, exhibitry and interpretive approaches (*The Experiment Gallery Conference Final Report*, 1997).

According to the final report, the conference program was as follows

Monday, July 21 -- Pre-conference Activities	
Be an Evaluator	10:00 to 11:30 a.m.
Be a Docent (Science Coach)	1:00 to 2:30 p.m.
Tuesday, July 22 -- Conference	
Kickoff Session	10:30 to 11:30 a.m.
What is Inquiry-based Learning?	1:00 to 2:45 p.m.
Prototyping an *Experiment Gallery* Style Exhibit	3:00 to 4:30 p.m.
Wednesday, July 23 -- Conference	
Creating Exhibits for Different Learning Styles	9:00 to 10:45 a.m.
Creating "DMNH Labels" for an *Experiment Gallery* Style Exhibit	1:00 to 2:45 p.m.
What is the Value of Having Objects in an Exhibit?	3:00 to 4:30 p.m.
Thursday, July 24 -- Conference	
Evaluation Findings on the *Experiment Gallery*	9:00 to 10:15 a.m.
How Does an Exhibit Like the *Experiment Gallery* Fit into DMNH?	10:30 a.m to noon
Wrap-up Session and Discussion	1:00 to 3:00 p.m.

The conference was attended by staff from many departments, including Exhibits, Education, Marketing, Administration, and Collections. Attendance at the various conference sessions varied from 20 to 37 participants, although the pre-conference sessions attracted only five to 13 participants (*The Experiment Gallery Conference Final Report*, 1997). Some respondents expressed disappointment that there were not as many staff from the Collections Department as they had hoped.

The *Traveling Experiment Gallery* seemed to play the following roles in the conference program.

- Served as a point of departure for discussions at every session.
- Served as a "field trip" and "field test" site for several of the sessions.
- Played a major role in teaching the museum's staff about inquiry and open-endedness in exhibits and programs.
- Helped get staff talking about things they didn't normally talk about.
- Helped get staff talking with people from other departments, who they usually didn't talk with about these sorts of topics.

As part of Denver's "experiment" with the *Traveling Experiment Gallery*, the museum's in-house evaluator conducted an evaluation of the exhibition. We were privy to their findings through interviews with the staff evaluator and through a two-page "Preliminary Findings from Evaluating the Experiment Gallery" included as part of *The Experiment Gallery Conference Final Report* (1997). The in-house evaluation included observations and limited tracking studies of visitors, a visitor survey, and interviews with exhibit floor personnel.

We made a site visit to Denver over a three-day weekend, June 27-29, 1997. We conducted depth interviews and unobtrusive observations at the museum for a total of approximately 33 hours of data collection. In addition, phone interviews were conducted before the site visit and at intervals during the year following the site visit. We conducted depth interviews with three full-time staff, including Laura Brown, Manager of Temporary Exhibits; Claudette Wallace, Project Manager for the *Traveling Experiment Gallery* installation; and Margie Marino, Staff Evaluator in the Exhibits Department. We also interviewed three summer staff who functioned as Team Leaders for the volunteer corps (Larry Crowley, Rae

Lyn Platt, and Richard Younger) and four volunteers who worked on the exhibit floor (Paula Hansen, Dave Martinez, Randy Mills, and Matt Spiegel). In addition, we held a group discussion with 10 volunteers who were working on Denver's in-house evaluation of the *Traveling Experiment Gallery*. We also spend about ten person-hours observing visitors, staff, and visitor-staff interactions, and we conducted six interviews with visitor groups.

Cranbrook Institute of Science

The fourth venue in this study was Cranbrook Institute of Science, in Bloomfield Hills, Michigan. The *Traveling Experiment Gallery* was at Cranbrook from September, 1997, through early January, 1998.

The Cranbrook Institute of Science was part of the larger Cranbrook Educational Community, which also included schools and an art museum, all located on a large wooded campus. Respondents said they considered Cranbrook Institute of Science to be close to the boundary between a medium and large museum. The permanent exhibits included both classic collections-oriented natural history exhibitions and a popular hands-on physical science hall. Cranbrook also housed both natural history research collections and curatorial staff. Respondents said that visitation averaged somewhat more than 200,000 per year, and that guided school groups where a major part of their audience.

Traveling Experiment Gallery was installed in a 2,400 square foot temporary exhibition hall. Because the initial floor plan of the exhibit felt crowded to both Cranbrook and Science Museum staff, respondents said they elected to drop the *Resource Area* from their final floor plan. Respondents justified this decision by pointing out that the *Resource Center* took up lots of space; they did not expect its resources would be well used by their audiences; and there were other areas of the museum where visitors could sit and rest. The *Activity Station* was positioned so that it both faced the entrance of the exhibit hall and gave *Activity Station* personnel a view of most of the exhibit hall.

Respondents told us that Cranbrook had, in the past, installed and staffed several activity spaces as part of larger temporary exhibitions, but that they had always done so in an enclosed space adjacent to the main temporary exhibit hall. Respondents compared their earlier approaches to the much more open *Activity Station*, and listed advantages and disadvantages of the two approaches. The *Activity Station* seemed to have the advantage of being right there in the main exhibition, and that may have encouraged one-to-one interactions between staff and visitors. A major disadvantage of the *Activity Station* approach seemed to be that it was hard for the demonstrators to maintain their high energy levels all day, mostly because they had to compete with noise and other distractions from the main exhibit space. Respondents also said their impression was that most visitors didn't stay there very long, compared with the more enclosed activity space. Despite the perceived disadvantages of the *Activity Station*, respondents told us that they were planning to adapt this exhibit approach to their upcoming *Robot Zoo* exhibition the next summer.

Respondents told us that Cranbrook had at least one paid staff and two volunteers scheduled each day. Although the *Experiment Gallery* was open on Friday and Saturday evenings, it was not staffed at these times. Three temporary part-time staff were hired for the exhibition. We were interested to note that they worked for the special events office, rather than for the Education Department. Respondents also told us that they had recruited a good group of volunteers, and that many of the volunteers were seniors citizens. A few volunteers were students at the high school on the Cranbrook campus. There was a separate one-day training session for staff and three two-and-a-half hour training sessions for volunteers. The part-time gallery staff assisted with volunteer training.

Respondents said that the Education Department did not develop special tours of the *Traveling Experiment Gallery*. However, schools groups typically were given a half hour to an hour of "browse time" before, after, or between their regularly scheduled school programs. They were free to spend some of that time in *Traveling Experiment Gallery*.

At the time of our site visit construction was being completed on a major new addition to the museum, and the new exhibitions for this wing were being developed and designed. Cranbrook Architecture Office, the group working on the exhibitions, was administratively separate from the Exhibits Department at the main museum and was housed in a separate building in Southfield, Michigan (an hour round-trip away).

We interviewed staff both by phone and during a three-day site visit to Cranbrook. We interviewed five full-time staff, including Larry Hutchinson, Curator of Exhibits; Melissa Pletcher, Coordinator of Volunteers and Special Events; Mike Stafford and Mark Uhen, research scientists on staff at the Institute; and Jenifer Lienau, Exhibit Developer with the Cranbrook Architecture Office. We interviewed two part-time Demonstrators who worked in *Traveling Experiment Gallery*, Michelle Akers and Correen Mandziuk, with two volunteers who worked on the exhibit floor, Barbara Bitterman and Sereana Seim. We also spend about eight person-hours observing visitors, staff, and visitor-staff interactions, and we conducted six interviews with visitor groups.

Sloan Museum

The fifth venue was the Sloan Museum in Flint, Michigan. The *Traveling Experiment Gallery* was at Sloan from late January through May, 1998.

Sloan was a medium-sized museum that started out as primarily a local history museum, with significant collections and exhibitions related to the history of the auto industry in the Flint area. At the time of our site visit, about two-thirds of their space was devoted to history and automotive exhibits. Our respondents told us that Sloan started bringing in science-related temporary exhibits about 15 years ago, and they gradually have been broadening their mission to include an increasing number of science programs and exhibitions. Their most recent addition to their permanent exhibitions was the two-year old Discovery Center, a hands-on science area. Respondents told us that they do permanent exhibits in-house, and that they have their own exhibit shop.

Sloan's Discovery Center was a hands-on gallery and classroom that seemed to exemplify their philosophies of science and museum education. It included a variety of free-standing science interactives and informal experiments on tables, plus Discovery Boxes that visitors could check out and use at the tables. Although the heaviest use of the space may have been by school programs on weekdays, the Discovery Center was also open to the public on weekends. Respondents described the educational philosophy behind the Center as "discovery learning," which they characterized as self-directed and multi-faceted, with more variables to work with than in more traditional exhibits. Some respondents told us that Sloan also had a long tradition with inquiry-based learning, which they first developed as an approach to history education. Based on the successes of the Discovery Center, the Sloan exhibits and education staff were in the process of installing a Hands-on History Center with a parallel philosophy and design.

For several years Sloan Museum had maintained a lockable, 3000-square-foot exhibit space in an empty store at a local shopping mall. Respondents told us that Sloan's original plan was to put *Traveling Experiment Gallery* in this mall space, but that several things happened at about the same time to prevent this (including the mall management finding a new tenant

for the space). Previous traveling exhibitions in the mall space had included numerous interactive exhibits, a "lab" where museum staff conducted demonstrations for the public, and other "activity stations" which were in some ways similar to the *Activity Station* in *Traveling Experiment Gallery*. Some of Sloan's floor staff for *Traveling Experiment Gallery* had gained experience with exhibit maintenance and interacting with the public in these mall exhibitions.

The *Traveling Experiment Gallery* was installed in the Sloan Museum's 3,400 square foot temporary exhibit hall, immediately adjacent to the Discovery Center. The *Activity Station* was purposely hidden from visitors' view as they entered the *Traveling Experiment Gallery*, so that it wouldn't interfere with groups working in the Discovery Center.

Sloan Museum had experience with staffing exhibit halls in both the main building and the mall satellite exhibits. Respondents told us that they staffed the Discovery Center with Education Department staff and sometimes volunteers, at least on weekends. Respondents said Discovery Center staff roles were similar to the roles of the *Traveling Experiment Gallery* staff, and that they also served as role models for visitors by taking out a box and doing something with it, helping to get visitors started. Respondents with experience in the mall exhibits said their responsibilities included admissions, "floating" on the exhibit floor, helping children with activity sheets, doing science experiments for school groups, and sometimes explaining exhibit concepts to visitors.

Sloan Museum hired a college student to serve as a Demonstrator for *Traveling Experiment Gallery* on weekends. Respondents told us that, on weekdays, the full-time Education Department staff were in the exhibition during school tours and at other times when visitors were in that part of the museum. (Visitors had to walk past the Education Department office and the Discovery Center to get to *Traveling Experiment Gallery*.)

Respondents told us that five or six volunteers participated in training for *Traveling Experiment Gallery*, and they all contributed at least some time in the exhibition. However, only one volunteer seemed to be working on a regular weekly schedule.

There was one day of training for the museum staff and a second day of combined training for staff and volunteers. The weekend Demonstrator, who had not been able to attend the training sessions, learned the *Activity Station* experiments from full-time staff and read the *Let's Try It...* book and other references to "fill in the gaps."

School tours seemed to be a very important aspect of the Education Department's mission at Sloan Museum. Respondents said they designed tours specifically to support the curriculum by setting clear goals related to the state goals and state assessments. Apparently Education Department staff had difficulty fitting the *Traveling Experiment Gallery* into this program-design philosophy, in part because the information that was provided about the exhibition did not seem to them to be specific enough to develop curriculum-related tours. Respondents also pointed out that, despite fairly heavy promotion to teachers, the *Traveling Experiment Gallery* didn't draw "strong numbers." This may have been because area teachers tended to develop a "comfort zone" with particular tours, and that it usually took several years for a new tour to become popular. The teachers who used *Traveling Experiment Gallery* seemed to be those who were already comfortable with the topics covered in the exhibition, or who already came multiple times to the museum each year.

We both conducted phone interviews with Sloan staff and made a three-day site visit to Sloan Museum. We interviewed six full-time staff, including Jim Johnson, Associate Director; Steve Laux, Curator of Education; Nancy Cook, Associate Curator of Education;

Jim Owen and Doreen Homa, Educational Associates; and Warren Lehmkuhle, Exhibit Technician. We also interviewed Amy Lane, the part-time Demonstrator who was responsible for the *Traveling Experiment Gallery* on weekends. There were no volunteers scheduled to work during our site visit.

We also spend about nine hours observing visitors, staff, and visitor-staff interactions, and we conducted four interviews with visitor groups.

Science Museum of Minnesota

In addition to interviews with staff and volunteers at the host institutions, we also talked with four staff at the Science Museum of Minnesota:

- Paul Maurer, who was Director of Exhibits at Science Museum of Minnesota, Project Director for *Traveling Experiment Gallery*, and Principal Investigator for the National Science Foundation grant.
- J. Newlin, who was Director of Physical Sciences & Technology at Science Museum of Minnesota and Science Director for *Traveling Experiment Gallery*.
- Bill Maloney, who was head of Touring Exhibits at Science Museum of Minnesota. Maloney handled promotion, scheduling, contracts, and many other administrative aspects of the *Traveling Experiment Gallery* tour.
- Jane Snell Copes, who developed many of the training materials for the *Traveling Experiment Gallery* tour, and who conducted the staff and volunteer training sessions at most of the host institutions.

In all, we interviewed 28 staff and six volunteers during this study. We also interviewed 16 visitor groups, which included 32 individual visitors, and we informally observed many more visitor groups (Appendix B). The visitors who we observed and talked with included casual visitors to the museum, who visited either singly or as part of a small social group. We also observed members of school and other organized groups who were touring the museum. In addition, we reviewed many written documents and materials, including the *Experiment Benches Summative Evaluation Report* describing the study that Selinda Research Associates conducted a number of years ago (Perry, 1994).

MAJOR THEMES THAT EMERGED DURING THE STUDY

Overview

Based on our conversations with staff, volunteers, and visitors, it appeared that the *Traveling Experiment Gallery* was a successful exhibition, filling an important niche at each of the host institutions.

Staff at the host institutions talked about almost all aspects of the *Traveling Experiment Gallery* in extremely positive terms. Respondents spoke very highly of the levels and types of interactivity in the exhibit, the exhibit design and use of materials, the "feel" of *Traveling Experiment Gallery*, and the support provided by Science Museum of Minnesota staff. Overall, the reception of the *Traveling Experiment Gallery* seemed exceptionally positive, particularly when respondents compared their experiences with other traveling exhibitions.

On the whole, the visitor experience also seemed very positive. Most visitors said they enjoyed themselves and wanted to return. The exhibit seemed to appeal to a broad range of visitors. There were many indications that the exhibit worked particularly well for children from about fifth grade and up, and many adults seemed to become engaged with their children or on their own. Groups with younger children seemed to have a harder time finding appropriate activities. Visitors seemed to consider many of the exhibits to be fun, but other exhibits seemed to be challenging enough that they were labeled "hard" rather than "fun." A few exhibits seemed to be sources of frustration to both visitors and to the floor staff and volunteers who were trying to serve them.

Promotional Materials and Initial Expectations

In order to promote the *Traveling Experiment Gallery* to museums around the country, a packet of promotional materials was developed and sent out to museums that requested them. The promotional materials provided by Science Museum of Minnesota's traveling exhibits program were important to the success of the *Traveling Experiment Gallery*, because they created many of the initial expectations in the host institutions and helped them to prepare for the experience to come.

As we talked with respondents at the earlier institutions, we learned that the early drafts of these materials were only moderately successful at preparing them to host the exhibition. There were indications that host institutions, after perusing the materials, did not fully understand the staffing requirements, the costs associated with running the gallery, and the daily maintenance requirements. As we began our interviewing, Science Museum of Minnesota staff had already identified and begun to respond to this issue by, for instance, increasing their emphasis on staffing requirements in the initial promotional packet and adding a detailed walk-through of the exhibit, with slides and script.

Staff at the later host institutions also used other sources of information to find out about the *Traveling Experiment Gallery*. These sources included phone conversations with Science Museum of Minnesota staff, visits to the exhibition while it was installed at host institutions that were earlier on the schedule, and conversations with staff at these earlier host institutions. We were pleased to learn that Science Museum of Minnesota staff initiated many of the phone conversations with these later hosts. Respondents at the later institutions seemed to feel that there was no substitute for a site visit to the actual exhibition.

Costs to Host Institutions

Many respondents remarked at the relatively low fee charged for the *Traveling Experiment Gallery*. Most full-time exhibits and administrative staff seemed to be aware that the exhibit fee was subsidized, and many, but not all, recalled that National Science Foundation was the sponsor.

Reactions to the out-of-pocket costs for daily maintenance seemed to vary with the size of the institution. At a small institution, $6.00 per day for dry ice seemed like a large expense. At larger institutions, daily maintenance costs seemed to be considered trivial.

At most institutions, the cost of staffing the *Traveling Experiment Gallery* was considered to be relatively high. The host institutions incurred much of this cost through the time spent by full-time staff either in the gallery themselves or recruiting and supervising part-time staff and volunteers. Some host institutions hired part-time, temporary gallery staff for weekends and, in some cases, weekdays as well.

Although the cost of staffing the gallery seemed relatively high, most respondents considered floor staff and volunteers to be a critical part of the visitors' experience of the *Traveling Experiment Gallery*. Therefore, for the most part, respondents agreed that meeting staffing requirements was worth the added expense.

When potential increases in attendance were taken into account, the *Traveling Experiment Gallery* was expected to, at best, break even or even lose money at most of the host institutions. Our respondents seemed to expect this and said they were not bothered by it. Several respondents referred to *Traveling Experiment Gallery* as a value-added experience for their visitors, rather than as a money-maker for their museum.

Public Relations Materials Provided to Host Institutions

As part of touring the *Traveling Experiment Gallery*, Science Museum of Minnesota provided public relations materials that were used by the host institutions to communicate with their publics. As part of this evaluation study, we were interested both in how well host institutions felt served by these materials, and in how these materials were used by the host institutions.

While for the most part the materials appeared adequate, we learned that at least one institution did not receive the materials early enough so that they could effectively be distributed to the local media.

> *We are quite accustomed to having a complete promotion packet, one binder full or whatever sent out to us early. And sometimes exhibitors will conditionalize it...or they just say after a certain point, then we'll send it out....We need to get our marketing done as soon as possible. And a lot of the [*Traveling Experiment Gallery*] marketing things didn't come until a few weeks prior to the opening of the exhibit. So it kind of left us scrambling. [R110]*

There were indications that at least some institutions considered marketing this exhibition to be a difficult task.

It's a difficult one to market....It's not exactly the sexiest name in the world....It's not sort of a catchy thing. [R116]

Despite this perceived difficulty, some of the host institutions received free publicity in their local press, with published photographs and short reviews of the exhibition.

Size of the Exhibit Space and Configuration of Components

Traveling exhibits by their very nature have to be adaptable to a wide range of gallery sizes, shapes, and amenities. These conditions can greatly affect the quality of the visitor experience. To date *Traveling Experiment Gallery* has been housed in spaces ranging from 1,200 square feet to almost 5,000 square feet. It appeared to do well in all configurations, with three major exceptions.

- In the smallest spaces, large crowds could be a major problem, detracting from the apparent success of the exhibition.
- In one case the *Resource Center* was left out of the exhibit because it made the relatively small space seem too crowded to the designers.
- In the largest space, there were empty, dark corners within the gallery. Some respondents questioned whether the room was too spacious, and some said this detracted from the visitor experience.

As might be expected, respondents had different things to say about the size of the exhibit space and related perceptions of crowdedness, intimacy, and spaciousness. For instance, one respondent told us that the smallest exhibit space was a perfect size for a single class of students, and another respondent told us that the recommended 2,500 square feet felt far too crowded to her.

One of the major variables in the configuration of the exhibit components was the location and aspect of the *Activity Station.* Many respondents said they wanted to have the *Activity Station* prominently visible as visitors entered the gallery. In those configurations where this effect was achieved, there were indications that the *Activity Station* and its staff played a major role in introducing visitors to the exhibition.

Interactive Maintenance and Support

Given the highly interactive nature of the *Traveling Experiment Gallery,* we anticipated that exhibit maintenance would be a critical issue for both host institutions and visitors. Highly interactive exhibitions often face a significant amount of breakage or things just plain wearing out. We were also interested in what happens behind-the-scenes in anticipation of exhibit breakage. What do Science Museum of Minnesota and the host institutions do to avoid such problems? And when a problem occurs, what do they do to solve it? Finally, we were interested in support provided from the Science Museum of Minnesota. How does the Museum respond to requests for help? What kinds of support are they able to offer?

We were both surprised and pleased to hear that, in the eyes of host museum staff, exhibit maintenance has not been a major problem. Some respondents cited the design and construction of the exhibition as an extremely positive aspect of their experience and an

important reason why maintenance was, from their perspective, relatively easy. For instance, one respondent compared *Traveling Experiment Gallery* to commercially built exhibits:

> *The interesting thing about seeing a museum that develops something and seeing a for-profit that developed something, is you can tell the difference when somebody has to live with it, or has lived with stuff for a long time. And their approach is just so different....I think just the beefiness of the structures [in the* Traveling Experiment Gallery*] was pretty apparent. I think the use of $3 switches that are available out at arcade shows that they've had enough experience to know that you don't need to use a $200 switch which is going to fail. Which is what happened to us. The access to the guts of exhibits was -- is always -- very important. And the number of moving parts is also very important. So all those things I think were on the plus side for the* Traveling Experiment Gallery. *[R116]*

All of the respondents also talked about the strength and quality of Science Museum of Minnesota's maintenance support. Here's what one staff member had to say:

> *When Jay [Higashi, the Tour Manager] was here he actually worked with the exhibit staff and trained them in what he wanted them to be able to do, and whenever they had any problem they would just call him up directly. And talk to him directly and it was great. I mean I was talking to [our exhibit maintenance technician] today, and he was saying you know he's never had a better support from anybody than Jay....as far as exhibit repairs. That's pretty good. They do a lot of exhibits through here, about four a year, and he's been doing them for eight years. So that's a fairly good compliment. [R125]*

Most respondents told stories about a few breakdowns and other glitches in interactive maintenance. However, they said they expected these sorts of thing to happen, and the breakdowns didn't seem to have affected their overall positive feelings about Science Museum of Minnesota's support. In fact, Minnesota's quick and thorough response to the problems seemed to confirm the respondents' positive feelings about the maintenance process.

> *We were having troubles with the keyboard....Jay Higashi wanted to fix the problem. He just didn't want to remedy it for a while. He wanted to fix it. And I agreed. I said I'd be willing to put up with a little bit of inconvenience if once it comes up here, it's fixed for good. And once they did come up and fix it, it was fixed for good....I deal with traveling exhibits quite a bit, and I [know that] those things break down. Things happen....It's not so much having to put up with the little inconveniences. It's just making sure that the people are sincere enough to actually fix the problem once and for all. [R110]*

In the next section of this report, we'll give some more details about what Science Museum of Minnesota seems to be doing well -- and thus should keep on doing -- in terms of interactive maintenance and support.

Best Practice in Providing Maintenance Support for Traveling Exhibitions

There were many indications that the Science Museum of Minnesota has a reputation as a place that does traveling exhibits really well. Respondents often detailed the ways in which their experiences with *Traveling Experiment Gallery* confirmed their positive feelings about the Science Museum and its staff. We believe that we can begin to define best practice in

providing support for traveling exhibitions based on hosts' reactions to the ways in which Science Museum of Minnesota has been supporting the *Traveling Experiment Gallery*. That's because, according to many host staff, the Science Museum of Minnesota provided them with the best support they have ever experienced for a traveling exhibit.

What follows is a list of some of the things that Science Museum of Minnesota appears to be doing really well. It's important to note that best practice for supporting an exhibition begins long before the exhibition ever hits the road.

Design of the Interactive Exhibits

The design and construction of the *Traveling Experiment Gallery* seemed to facilitate both its daily upkeep and its longer term maintenance -- in other words, best practice for *supporting* a traveling exhibition begins with the design phase of the project. Many respondents expressed surprise and delight about how well the Experiment Benches and other interactive exhibits stood up over time. Of course, it certainly helped that most of these interactives were conceived as traveling versions of exhibits in the existing *Experiment Gallery* in St. Paul. Their earlier incarnations had been gallery-tested for several years.

Here are some aspects of the design and construction of *Traveling Experiment Gallery* that seem to play a role in best practice for maintenance support.

- The interactives were designed and built with durability in mind. Respondents told us they were impressed because the interactives didn't break as often as they expected, based on their experience with other interactive exhibits.

- The interactives were designed for ease of maintenance. For instance, respondents described the "guts" of the interactives as easily accessible and the components as easily and cheaply replaced.

- The interactives were designed and built with safety in mind. Examples cited by respondents included the clutch on lariat chain and ground default switches in water-filled units.

- Surface materials in the exhibits were selected so that cleaning wasn't difficult. For instance, respondents noted that there were no special finishes used, and that the finished surfaces were very durable.

Staff Training

It's interesting to note that respondents were able to talk about these design and construction features, in part, because the Science Museum of Minnesota exhibit technician explained many of these design features as he trained the exhibit maintenance staff. In fact, this aspect of training appears to be another element of best practice. It might be called training-for-understanding, as opposed to just training host staff how to carry out maintenance procedures. Training-for-understanding had several positive outcomes.

- It allayed host staff's fears about visitor safety and exhibit maintenance.

- It fully prepared host staff for their role in maintaining the exhibits.

- It gave host staff ideas about how they, themselves, could better design and build interactives for their museum.

Here are some other aspects of host-staff training that help define best practice.

- The Science Museum of Minnesota's exhibit technician had the patience to answer all of the host staff's questions well -- even the "silly ones."

- The exhibit technician warned the host staff about what was likely to go wrong.

- The exhibit technician showed host staff how to fix the things that were most apt to go wrong.

Installation Support

Here's a brief summary of some of the things that Science Museum of Minnesota seems to have done well in terms of supporting the installation of the exhibition.

- The truck was packed efficiently, according to a pre-determined plan. Respondents told us that many traveling shows are poorly packed, and this causes delays in exhibit installation.

- Because of this pre-determined plan, the Science Museum of Minnesota's exhibit technician knew exactly which exhibit element was going to come off the truck next. Unpacking was very efficient and often took less time than expected.

- The exhibit technician really understood each element of the exhibit. Respondents indicated that many traveling technicians do not demonstrate this level of understanding.

Support for Maintenance and Repair

Here's a brief summary of some of the things that Science Museum of Minnesota seemed to do well in terms of the maintenance and repair of exhibits.

- The exhibit technician was prepared to fix problems that were discovered during set-up.

- When an exhibit did break down, repair materials are usually available at the host site. That's because Science Museum of Minnesota left spare parts and tools at the site -- including odd-ball connectors, filters, and about "nine-tenths" of all the other things the host staff might need for minor repairs. Respondents contrasted this with other traveling exhibits they had experienced, where repair parts had to be shipped, often with delays of a week or more.

- The repair parts seemed to be very well organized, and the exhibit technician showed host staff where to find everything in advance.

- Respondents told us that the Science Museum of Minnesota exhibit technician contacted them periodically, by phone or e-mail, just to see how things were going.

- They also told us that Science Museum of Minnesota personnel responded quickly to calls for help from the host institutions.

- When the host sites were unable to make the repair, Science Museum of Minnesota staff often found long-term solutions to the problems, rather than quick fixes. They would pull the unit off the floor and replace it with something else while it was being overhauled or redesigned.

- Respondents told us that, when possible, Science Museum of Minnesota tried to solve major maintenance problems between venues (e.g., refinishing the *Activity Station*).

As some respondents pointed out that, the staff training was also a critical aspect of maintenance support -- when the host staff really understood the process of exhibit maintenance, they were less apt to damage the exhibits through misguided attempts at maintenance.

Benefits of "Best Practice" for Science Museum of Minnesota

These practices not only benefited the host institutions, they also contributed to the highly positive word of mouth that we heard about the Science Museum of Minnesota's traveling exhibits program. In part because they did these support functions so well, Science Museum of Minnesota staff were able to develop long-term relationships with staff at host museums, and these relationships seemed to play an important role in marketing the traveling exhibits program.

In so far as possible, Science Museum of Minnesota should continue to use experienced staff for support functions, and especially for staff training in *Traveling Experiment Gallery* maintenance and programming. Host staff said they were impressed by the depth of knowledge and sense of ownership exhibited by the Science Museum staff who traveled to the first five host institutions.

Daily Upkeep

Reading over the materials provided to us, we were impressed by what seemed to us to be the large daily effort it seemed to take to keep the *Traveling Experiment Gallery*, and particularly the *Activity Station*, up and running. We were interested in finding out all that is required to keep the exhibition operating smoothly and supplies filled, and to what extent this was a drain on the time and energy of the host museums' staffs.

As it turned out, although we listened as respondents read off long lists of their daily chores and followed gallery staff as they walked their morning rounds through the exhibit, we found no indications that the daily maintenance was creating major problems for the host staff. In fact, some of our respondents told us that daily upkeep was relatively easy, and not as much work as they had expected.

> *I would get there at 8:30 and it would take me about a half hour a day, just to make sure things were going well....And it would vary. You know, sometimes it wouldn't even take a half hour. It may take 15 minutes. But you just want to be able to go through, make sure things are cleaned up and in order. The* Resource Center *would be all messed up because of the kids from the day before. So you just want to make sure all the toys are in place where they can find them. [R110]*

At most institutions, daily maintenance was done by the gallery floor staff, rather than by exhibit technicians. Minor problems that were mentioned had to do with initial expectations about how much materials would actually cost and about how the staff would organize responsibilities such as the purchase of consumable materials. For instance, one respondent reported that their host institution was unprepared for the cost of the dry ice, which appeared to come as a surprise to them. Another institution apparently had some internal problems assigning the responsibilities for restocking supplies.

Staffing the Traveling Experiment Gallery

The *Traveling Experiment Gallery*, by design, was a staff intensive exhibition. Personnel were required to staff the *Activity Station* in particular; additional volunteers were very helpful as visitors interacted with the exhibit units. Given that this exhibition was designed to travel primarily to smaller institutions, we were interested in whether or not they would be able to fulfill the staffing requirements, and what would happen if they weren't.

There were indications that recruiting and maintaining appropriate levels of paid and volunteer staffing were difficult for some museums. While required staff levels were clearly specified in the materials the host institutions received from the Science Museum of Minnesota, there were indications that, particularly for smaller institutions, these staffing levels were difficult to attain. All the respondents who we talked with said that they managed to staff the exhibit on weekends and most other times when visitors were present. Some institutions had to rely on full-time staff on weekdays when volunteers and part-time staff were unavailable.

However, respondents agreed that floor staff played an extremely important role in the visitor experience, and that staffing the exhibit was well worth the effort and expense.

Recruiting Volunteers

Recruiting volunteers proved to be a problem at some host institutions. In some cases the museum staff admitted that, as an institution, they hadn't had much experience recruiting volunteers for this sort of position.

> *We're...sort of fledgling institution when it comes to volunteers. We haven't quite figured that [out]. We've given a lot of time and effort to that in the last year to try to really improve it. [R116]*

At another institution the people who usually volunteered for traveling exhibitions did not seem interested in participating in *Traveling Experiment Gallery*.

> *I don't know if...the [potential volunteers] were intimidated. But, you know, normally we can get a group of between ten and 20 docents just to come in during the week when we advertise for them. This particular exhibit didn't seem to come off that way for us. And I haven't quite identified why that is. [R110]*

Intimidation appeared to be a problem at other institutions, as well.

> *We got a bunch of our docents to come in [for training], and not one of them has -- maybe yes, there was one, who actually has done a lot of programming with this. The other ones came to the training and just simply have said they're not comfortable with it. And the one gal who does come regularly to help us out is younger. But most of these are retired teachers who come here because they like history and because they want to keep their hand in it. But they're really uncomfortable with science. [R127]*

One respondent wound up recruiting from what, for this institution, was a new source for volunteers: science education students from local universities.

This time around...we did have docents for the weekends to help with the labs and what not. And ironically they were young kids from the [universities]. I'd put a real push on to get some of those science students in to do that. And that was the first year we had a good turn out from that area. [R110]

The largest institution in the study already had a large pool of volunteers who had worked in other exhibits, and who were interested in working in the *Traveling Experiment Gallery*. As a result, respondents told us that they met and usually exceeded the staffing requirements laid out in the contract. In addition they said that they were able to be very selective about who was allowed to work in on the exhibit floor, accepting only volunteers who seemed to be committed to, or at least accepting of, an inquiry approach to learning. One respondent gave the following description of the screening process.

He brought us all in in small group interviews with about six or seven people and just basically talked to us. Kind of gave us some background as to what it would be for us in terms of the workload and all the other obligatory requirements, and then he took us over and we played with laser light and spectrums and...broken pieces of the laminated plastic they use for lighting covers, doing some different things and some spectrum glasses. And we experimented for ten minutes. And he said, this is what you're going to be doing....He said if you're not comfortable not knowing everything, this isn't the place, because you're going to have people who are going to ask you things that you're not going to know. And if you don't feel comfortable asking questions, this is not the place for you....It wasn't really a thing of saying, "You know, you're probably not going to do this." It was a lot of self-choice. [R122]

In part because of this screening process, this institution was able to develop a large corps of volunteers who regularly practiced inquiry-based learning with visitors.

Training Staff and Volunteers

Providing appropriate training for staff and volunteers was also extremely important. Science Museum of Minnesota staff provided several days of training for the staff and volunteers who ran the *Activity Center* and interacted with visitors on the floor. This training required lots of advance preparation by the host institutions, including recruitment of adequate numbers of floor staff and volunteers. When host institutions were able to prepare adequately, the training seemed to go well.

Jane Copes was very helpful with [the training] She came in and actually ran the volunteer training and the staff training as two separate events....Jane went way out of her way with all the training aspects of it. And providing her book and allowing us to make many copies of her book without any kind of copyright problems. And that was kind of nice you know. And I talked to Jane on the phone a few times just to kind of bring her up to date on what's going on. What she prepared people to do was more than sufficient for what they had to do. We didn't have anything else we needed to do as the months went on. [R125]

When the host institution's advance preparations didn't go as well, the hosts had to adopt alternative strategies for training the floor personnel.

Unfortunately I didn't have [program volunteers] lined up at the time when Jane Copes was there to teach....But I had Jane teach me everything. Fortunately I do have somewhat of a noggin for science. I'm no expert, but I feel very comfortable

with it. And I was able to then take that training and teach the docents, and we had seven docents working on the weekends. [R110]

The most successful approach to training seemed to involve separate training sessions for staff and volunteers, followed by continuing on-the-job training by the part-time gallery staff and well-educated volunteers. This respondent described this three-pronged approach to training as follows.

> *One, we [staff] were in here while the exhibit was actually being set up with Claire and a few other people from the Science Museum of Minnesota....We went through everything with the free-standing exhibits and went through everything in the activities. And we asked [questions] -- it was a chance for us to learn how things were done. And the people that design [the exhibits] were there....It was good to be able to ask a lot of questions. And a very good way to get familiar with all the stuff. And people that have obviously done them in a museum setting before, so they knew what to expect and so on.*
>
> *Then there is the portion where the volunteer training was. And we [part-time staff] were involved with that fairly heavily. We were there all the time....We helped the people from Minnesota train all of the volunteers. And we got familiar with them and that sort of thing. And that was a chance for us to start instructing people and be able to ask a little better questions.*
>
> *And then there is ongoing stage....Every time I come in here, I think I get asked a question that I don't know the answer to that's a really interesting question. And I go to the books over here....A lot of the volunteers in here are actually engineers....I've found a really good resource in some of the engineers on the motor activity. [R106]*

A training plan that combined the training of staff and volunteers seemed to be less successful, at least for those respondents who said they already knew a lot about science.

> *Jane did a nice job. She was very thorough, probably and maybe even more detailed than she needs to be when you're speaking with [full-time staff] people who have a background in science. But there were only a few of us....She was very good with the rest of the people. She needs to speak to those people -- I understand why....But she was very good and very detailed with the other people, so that they would understand. [R127]*

Several respondents told us that the training seemed a bit too slow, too basic, too thorough, and too detailed for experienced education department staff. However, these same respondents also said that the training worked well for volunteers -- in part because if was slow, basic, thorough, and detailed. Many respondents seemed impressed with the trainer's patience and passion for science education.

Some respondents said that, although they felt extremely well trained for their duties at the *Activity Station*, they felt much less prepared for working with visitors on the main floor of the exhibit. These respondents seemed to feel they could benefit from a publication, similar to *Let's Try It...*, that both explained the Experiment Benches and related exhibits and gave suggestions about how to help visitors understand and work with these exhibits.

We spoke with both staff and volunteers who admitted that they felt intimidated by the *Traveling Experiment Gallery* at first. Some respondents said they got over their intimidation by adopting the attitude, "We're all here to explore," rather than thinking of it as

a "know it all" situation. Indeed, many respondents said they felt better once they had accepted that they would not be able to answer every question asked by visitors. As one respondent put it, "When I don't know, it's okay to say I don't know." This seemed to come as something of a revelation to respondents who had tended to think of museums as places with all the answers.

> *I think one of the fears that we have sitting inside of a museum [is that] we have to know all the answers....And there's that fear of not knowing everything that I think keeps a lot of very wonderful volunteers away. [R122]*

Indeed, exposing and then "curing" your own ignorance seemed to be considered one of the rewards of working in the *Traveling Experiment Gallery*. This seemed to be particularly important to teachers who worked in the exhibition as part-time staff and volunteers.

> *I guess another reason why I was interested in doing this -- physics is not my high point in science. It's more biology. So I picked up a lot about physics. [R143]*

> *The stuff that we're presenting was not my strong suit. I can do astronomy all day long. I can do chemistry all day long. You know some of the chemistry stuff, physics and some of the physical sciences. Other physical sciences are not my strong suit. But again I consider my responsibility as a teacher to learn as much as I can. The more I learn, the more I can share with my students. [R122]*

Some floor personnel told us that overcoming their initial intimidation was a growth experience for them. One respondent told us that she had always had a shy personality, and that her experiences in the exhibition were helping her overcome her shyness. She told us that, "I'm breaking out of my shell."

Continuing Support for Floor Staff and Volunteers

As noted above, one host institution made a point of providing continuing training for its volunteers. The part-time staff provided most of this training, sometimes aided by volunteers with backgrounds in science, engineering, and education. Here's what one such staff had to say about these duties.

> *Our main purpose, I think, is to be a sounding board and to model some really good inquiry-based learning and question-answer techniques. To try to model the best we can so that all the volunteers and the teens are using those techniques. [R117]*

When asked how they modeled for the volunteers, one respondent described the following behaviors.

> *Talking to [visitors] around the exhibit. Trying not to just sit around when there are a lot of people in the exhibit. Interacting with people and knowing what's going on with the things. If I don't know, saying I don't know and finding out. And just asking visitors a lot of questions and again modeling that type of, I hate to say it, inquiry-based learning. [R106]*

This institution seemed to have developed a "culture on inquiry" among its floor staff and volunteers in the *Traveling Experiment Gallery*, based on (a) its ability to carefully select their volunteers and floor staff; (b) the continued on-the-job training and modeling of inquiry-based learning by the floor staff; and (c) the support and encouragement of both

the middle and senior management within the institution. This "culture of inquiry" did not seem to exist at the other host institutions.

At other host institutions, many floor staff and volunteers told us that they continued to learn more about the science behind the exhibits and about effective ways of working with visitors. Some of this continuing education seemed to be facilitated by the resources available in the *Resource Area* and by the training manual provided by the Science Museum of Minnesota (*Let's Try It...And See What Happens*). However, there were indications that most continuing education for floor personnel was self-education, with only minimal support from within the host institutions.

Components of the Traveling Experiment Gallery

Recognition and Appreciation of the Design

The aesthetics and ambiance of *Traveling Experiment Gallery* seemed to play an important role in both the staff and the visitor experiences of the exhibition. In some cases respondents said that they appreciated the warm, cozy, and friendly feelings inspired by the design. One respondent contrasted *Traveling Experiment Gallery* with the high-tech, finished look of many science exhibits, on the one hand, and with the garage-like design of the Exploratorium, on the other.

Other respondents were less positive in their assessment of the design. Some staff made unfavorable comparisons of the unfinished woodwork of the *Traveling Experiment Gallery* with the highly finished woods in some more traditional exhibition halls. Other respondents seemed puzzled by the use of raw plywood at the entrance to the exhibit and in the box-like Sound Lab, while everywhere else in the gallery, the wood seemed more highly finished.

Introductory Elements

There were some indications that the introductory elements of the *Traveling Experiment Gallery* were not being used as an introduction by most visitors. For instance, an in-house tracking study at one host institution found that most visitors, as they were entering the exhibit, did not stop at the introductory elements, but that a larger percentage of visitors stopped and played with the toys on the way out (*The Experiment Gallery Conference Final Report*, 1997). However, there were indications that some visitors noticed and, to some extent, responded to the overall look and feel of the entrance. Although the introductory elements probably failed to orient most visitors to the content and educational philosophy of the exhibit, they may have contributed to visitors' affective response to the rest of the exhibition.

Activity Station

There were many indications that the *Activity Station* was extremely popular with both staff and visitors, and that this section played a particularly critical role in the visitor experience.

> *The activity bench is extremely popular....And I've watched kids sit up there for probably 15 or 20 minutes blowing soap bubbles in the dry ice. Just doing that over and over and seeing what happens when they can -- if they can get it down to the dry ice and freeze the soap bubble on the dry ice. And they're really engaged in what's happening up there. [R128]*

At most institutions where the *Activity Station* was visible from the entrance, many visitors stopped there early in their visit (*The Experiment Gallery Conference Final Report*, 1997;

Faulkner, 1997). There were indications that the *Activity Station* helped serve as their orientation to the rest of the exhibition. Some floor personnel said they had to encourage visitors to leave the *Activity Station* and explore the rest of the exhibition.

There were also indications that the *Activity Station* was one of the most popular and effective parts of the *Traveling Experiment Gallery* for younger children (e.g., Faulkner, 1997). Both the friendly, accessible staff and the simplicity of many of the activities combined to make the *Activity Station* a highlight of their visit.

The Chromotography, Carbon Dioxide (especially dry ice), and Resonance activities seemed to be favored by floor personnel at all of the host institutions and were thus the most used activities. The Acids and Bases and Weather activities seemed to be used less often. We were told that the fire tornado set off the fire alarms at one institution, however it seemed to be popular at other institutions (which apparently had less sensitive fire alarms). Although some floor staff seemed to really enjoy working with the Motors and Magnets, a few told us that they felt intimidated by the subject matter and hadn't yet had an experience that would change their negative feelings.

Some respondents wanted to increase the impact of the Activity Station by (a) increasing its size; (b) increasing the level of staffing; and/or (c) making certain that the *Activity Station* always faces the entrance of the exhibit.

> *I'd double the size of the* Activity Station. *And right up front make sure that you get two staff staffing it at all times. Because that being the centerpiece of [*Traveling Experiment Gallery*], that's a critical element and it should have a relatively large role, too. [R125]*

Resource Area

In interviews with staff at the earlier host sites, we had heard what seemed to be conflicting reports of the use of this area. Respondents told us that they saw the *Resource Area* as either a failed attempt at including a reference library in the exhibit, as a useful resting area for parents, or a highly successful area for pre-school children. Based on our site visits and some tracking data collected by one of the host institutions, it appeared that the *Resource Area* did, in fact, fulfill all of these functions to some degree, and in addition it played a role in the continuing training of gallery personnel.

- Resting Area. There were indications that most visitors used the *Resource Area* as a rest area, and that this function may have been particularly important for older adults and others who suffered from "museum fatigue." An important subgroup of "resters" was parents whose kids were still in the exhibit. There were indications that the existing design was less than adequate for these parents, because the *Resource Area* walls prevented them from having a clear view of their children. For this reason, some respondents recommended removing the walls.

- Pre-School Area. Some parents also used the *Resource Center* as an area for babies and preschoolers to rest and play with puzzles. They would sometimes pop in a video for a break. There were indications that the *Resource Area* was too small to fulfill this function well, and some respondents wanted to see more interactive materials here for younger children.

  A lot of them are families with young kids, especially with the tessellated shapes and these shapes over here and the Etch-a-Sketch and that sort of thing. And a fair number of the videos do go on....I think [the videos are] more focused towards

parents who want to get their young kids to sit down and watch something. I think that's the most common. [R106]

- Reference Library for Visitors. There were indications that this was the least common function for this area. Only a few visitors sat and really looked at the books with the apparent goal of learning more about the science. However, this seemed to be an important function to these visitors.

  Parents...find [the Resource Area*] even on their own without any prodding. And they come to check out the books. "Where can I get this book?" They want to know where they can get it. Where they can buy it? [R117]*

- Reference Library for Staff and Volunteer Training. Some respondents said they would go in and pick up books to answer visitors' or their own personal questions. Also, Team Leaders at Denver said they used the books in the continuing, on-the-job training of teen-aged volunteers. One respondent told us how the *Resource Center* contributed to her continuing education about the science behind the exhibits.

  The library that's set up back here, I like that idea, because I'm a reader. And I've picked up some books back there and read things. Even learning concepts of how everything's made up of particles blows my mind. I learned that a long time ago, but I see it differently now. And I'm more excited about it now. You know, learning about, reading about light....It's really interesting. And something like this, I think, definitely tunes you into your environment more, and what's around you in your daily existence and the way the world works. It's incredible. [R123]

Most respondents seemed to feel that the *Resource Area* was a wise use of space, and some even considered it a critical part of the *Experiment Gallery*. However a few respondents, who focused on the reference library function, considered the *Resource Area* to be the most expendable part of the exhibit. Indeed, when pressed for space, one host site elected to drop the *Resource Area* from their installation.

Experiment Benches and Other Exhibits

The *Experiment Benches* and more traditional exhibits generally received very positive reactions from staff, volunteers, and visitors. Many of these exhibits were considered to be fun by both visitors and floor personnel. However, other exhibits were regarded as just plain hard.

For example, several of respondents cited the Coriolis Fountain as an exhibit that visitors both enjoyed and had a great deal of difficulty understanding.

Unfortunately, I don't think there's a way to do [the label for the Coriolis effect] quickly and easily. But that's everybodys favorite. God, they love that one. That's my personal favorite too. And I still don't know that I really truly understand that. And that's my disequilibrium. Is to continue to walk over there when it's slow and really ponder that. Because what I'm trying to do is, I'm trying to put old style logic on it and it's not going to work. And that's what's frustrating me. And that's one where it is possible to create too much frustration...because that one is a very, very difficult. That's very hard to conceptualize. So I tend not to try and ask a lot of questions there. I just say, "Isn't that neat? Why do you think that does that?" [R122]

The exhibits perceived as more difficult seemed to share one or more of these characteristics.

- Their directions had many steps to follow. If a visitor missed or messed up one or more steps, the results were ruined (e.g., Making Snow).

- Some visitors had a hard time figuring out what they were supposed to do, often because they were given lots of options (e.g., Electricity Bench).

- To get started in the exhibit, some visitors felt they had to know things that they didn't actually know, or they felt intimidated by the entire subject area (e.g., Electricity Bench).

- Some exhibits dealt with concepts that were very difficult for visitors to grasp even on the most basic level (e.g., Coriolis Fountain), or with concepts that were already misunderstood by many visitors (e.g., Orrery and Seasons computer).

As a result, both visitors and volunteers felt frustrated with some of the exhibits. Most respondents regarded frustration as a bad thing, but some floor personnel said they tried to figure out ways to put visitors' frustration to work for them. There were indications that staff and volunteers who were more sophisticated with the inquiry approach seemed to be more accepting of visitors' frustration. There were also indications that visitors who were able to operate higher on the inquiry hierarchy (described below) were more tolerant of their own frustration.

Physical Safety of Visitors and Staff

As far as we have been able to discover, *Traveling Experiment Gallery* was no more dangerous, and quite possibly less dangerous, than other hands-on science exhibits. However, at least some staff told us that they worried that some components in *Traveling Experiment Gallery* might be unsafe. Perhaps Science Museum of Minnesota should consider ways to be proactive about these concerns.

The lariat chain attracted the concern of many respondents.

> *[The lariat chain] scares a lot of people. I'm actually surprised our security department has allowed it to stay up. We thought they might close that one down. But so far so good. No one has been hung....If security in the end says this is a hazard, we can't do it then. So far they have not done that. [R128]*

Three approaches seemed to alleviate staff concerns about the safety of the lariat chain.

- Seeing the exhibit in action at another host institution, and talking with their staff.

- Learning about the safety mechanisms incorporated in the exhibits, generally from the technician who arrives to install the exhibit at their institution.

- Seeing the exhibit in action at their own institution.

The combination of observation and explanation worked for this respondent.

We went to Cranbrook....If we could see the exhibit prior to it arriving, we know what to expect. And boy, they had a mob in there the day that we went down. So it was [great] to see it really crowded, you know. A lot of kids. A lot of school groups. And our first thought was oh, boy, when we walked in and saw the [lariat chain] running out there. We watched the kids, watched what they did, watched what happened, and saw there was no problem, and asked questions too of their technical people down there. And then, we felt very comfortable with it. So we didn't figure there was a liability problem. And that, because it's got a clutch on it, as well, you know. And they were very good about showing us, too. If you grab hold of the chain, it stops. There's no problem. [R142]

By the time we talked with them, most respondents had enough experience with the *Traveling Experiment Gallery* to realize that the exhibits were relatively safe, compared with other shows with many interactive elements.

There isn't anything in there that's dangerous. And that usually does not happen when you get a show. There's usually something in there I'm kind of worried about. Either it's going to break right away or I'm concerned about the safety of it. In almost every show, there's at least one area I'm kind of concerned about. And in this show, there hasn't been. And that's kind of nice. That shows me those people in Minnesota had their act together. [R115]

*[*Traveling Experiment Gallery *is] less dangerous than* Science of Sports. *[That's] a traveling one by COSI. We had a broken jaw in* Science of Sports. *And apparently Flight --* Flight: Where Adventures Take Off *from the Children's Museum of Indianapolis...had a broken jaw. So we get that one in October. [R128]*

Many of the floor personnel had a different set of concerns, about the safety of the activities at the *Activity Station*. Respondents told us that safety issues were covered during staff and volunteer training, and that they tried to practice safe science as they worked with visitors.

We did have to take some safety precautions. Obviously when you're doing the fire tornado that was completely controlled by the person giving the demonstration. But when it came to carbon dioxide...I had certain things designated for certain age groups. Like the bubbles were always for the little kids. The blowing solution, the blowing blue, I would usually give that to a couple of adults....I didn't want any kids. Because if you give the blowing blue solution to a kid, you know darn well he's going to drink it or she's going to drink it. You know they're just going to slurp right up in that thing. [R110]

Other respondents told us how they dealt with visitors' perceptions of their family's safety at the *Activity Station*.

There's different levels of comfort that different people have. A lot of times I ask the parent -- I always the parents first, "Is it okay if they touch this [dry ice]? Or do you want to?" I never say, "Touch it." [R117]

As it turned out, some of the greatest dangers come from rather innocuous looking items in the gallery. At one host site, when we were observing visitors at the *Activity Station*, a teen volunteer stood on a stool to reach up to a top shelf and then fell when the stool tipped over. Fortunately, no one was injured.

The Visitor Experience in Traveling Experiment Gallery

Overall Experience

There were many indications that the range of visitor experiences in the *Traveling Experiment Gallery* paralleled the range of experiences that visitors had in the original *Experiment Gallery* at the Science Museum of Minnesota. For instance, Perry (1994) found that:

- Some visitors spent long periods of time at the Experiment Benches.
- Visitors engaged in experimenting behavior at both the Experiment Benches and other exhibits.
- Visitors enjoyed being in control at the Experiment Benches.
- Some visitors experienced frustration and intimidation at the Experiment Benches.
- A few visitors appeared to experience particularly rich and meaningful learning experiences at the Experiment Benches.

We made similar observations during each of our three site visits and heard stories about similar experiences from staff and volunteers at all five host institutions included in this study.

Just as in the original *Experiment Gallery*, Experiment Benches and other exhibits in the *Traveling Experiment Gallery* appeared to be providing in-depth and meaningful experiences for visitors. These experiences seemed to be even deeper and more meaningful when skilled floor staff and volunteers were able to guide a visitors' interactions with the exhibits.

Designers' Apparent Assumptions About Visitors

One way to summarize the strengths and weaknesses of the *Traveling Experiment Gallery* is to consider some of the assumptions about visitors that seem to be designed into the exhibit, and then discuss how well those assumptions seem to have been supported by our observations and conversations at the five host institutions. We have recognized five basic assumptions about visitors:

Assumption 1: Visitors Are Honest

The Experiment Benches, *Resource Center,* and *Activity Station*, in particular, had lots of loose items that visitors could walk off with.

Assumption 2: Visitors Are Responsible

The *Traveling Experiment Gallery* provides potential vandals with lots of areas for mischief -- and with the tools for potential destruction.

Assumption 3: Visitors Want to Be Challenged

This seems to be inherent in the choice of subject matter, in the concepts behind the exhibits, in the label texts -- and in the inquiry-based approach to learning inherent in much of the exhibit.

Assumption 4: Visitors Want to Take Charge

There are at least two ways in which the exhibit lets visitors take charge: By making the choices available through the open-ended nature of many of the interactives, and by accepting the inquiry challenge by trying to ask and answer *their own* questions.

Assumption 5: Visitors *Can* Figure Things Out

In other words, the designers seem to believe that visitors have the combination of desire, intelligence, background knowledge, and perseverance to come to grips with complex ideas built into the exhibits.

Visitors' Response to the Design

Reality 1: Almost All Visitors Were Honest

We heard very few reports of theft -- host staff expressed surprise and delight at this result.

Reality 2: Most Visitors Were Responsible

We heard very few reports of malicious vandalism, and again, host staff expressed surprise and delight.

Reality 3: Many Visitors Tried to Understand Difficult Ideas

There were many indications that many visitors spent time trying to understand difficult ideas. Most visitor groups seemed to find at least one interactive that captured their attention, both physically and intellectually.

Reality 4: Many Visitors Tried to Take Charge

Many Visitors Tried More Than One Option. When visitors attention was captured by an exhibit, they often tried more than one option. Some options were suggested by the exhibit itself or by its labels. Other options visitors seemed to invent on their own.

Many Visitors Participated in Inquiry-Based Experiences. This reality is qualified by the observation that inquiry-based learning can be either supported or eliminated by the social dynamics of a visitor group. Some of the most successful inquiry experiences were mediated by skilled staff and volunteers who managed to become part of a group. However, we also watched parents guide their children through inquiry experiences, without knowing the terms for what they managed to accomplish. Some of the most didactic experiences that we saw happened to visitors traveling in groups with a self-appointed science expert. In these situations, many visitors surrendered their control to their companion's apparent expertise.

Reality 5: Most Visitors *Did* Figure Some Things Out

Here are some observations that, based on many lines of evidence, appear to be true.

No one figured out everything, unless they walked in knowing almost all of it already. Even staff and volunteers who were teachers, science students, and engineers, told us that they were still figuring out new things about the exhibits.

Most visitors figured out at least something if they devoted at least a few minutes to an individual exhibit. This is a trivial statement, really, since if visitors couldn't figure out anything about the exhibit, they most likely left after a short period of time. However, we also found that, if we talked to a visitor after their two to three minute experience, they almost always had something meaningful to tell us about their experience, even if their vocabulary and understanding of the complex principles were limited. At the very least, most visitors had an interesting question to ask about how or why the exhibit worked the way it did -- or didn't work the way they wanted it to work.

Most visitors had relatively insignificant learning experiences at most of the exhibits. Unfortunately, this was to be expected, since there were many complex exhibits in *Traveling Experiment Gallery*, and most visitors had little time to devote to them.

Some visitors enjoyed significant learning experiences. The strongest evidence for this comes from our conversations with floor personnel and our observations of their work with individuals and small groups of visitors.

Floor staff and volunteers played a significant role in many of these significant experiences. There were many indications that well trained and well motivated floor personnel could turn a potentially insignificant experience into a significant learning event.

Use by Young Children and Their Families

Although *Experiment Gallery* originally was developed for middle-school age children and adults, the traveling version of the exhibition was regularly used by groups and families with younger children. There was a range of opinions about how well the exhibit was working for children younger that six or seven. Some expressed the opinion that younger kids, without adults to read and supervise, didn't get much out of the exhibit, and some said they thought the exhibit just wasn't interesting for younger children. Others disagreed with these opinions and pointed to a range of exhibits that worked well for these ages.

We discussed this topic with a number of educators at the various host institutions. In terms of grade levels, most felt that the ideal age range for this exhibit was fifth through eighth grade; that the exhibition worked well for some fourth graders; but that third graders needed lots of assistance when visiting in a school group. It was generally agreed that first and second graders could do well in the exhibit with appropriate parental guidance. It should be noted that these respondents hadn't worked with many students older than eighth grade, so they weren't able to comment on how well the exhibit worked for high school and college students.

Of course, families were visiting the exhibit with children even younger than first grade. Some of our respondents thought that even toddlers and preschoolers were getting something out of the exhibit.

> *It depends on the two year old just like it depends on the five year old or ten year old or 20 year old. It just depends. I've had some two year olds that are just really good....They're actually having fun exploring and putting things together. I've had some two year olds that they just -- no attention span, just out the door. And so it just depends. [R117]*

> *I've seen a lot of parents going with little kids. In strollers. Not necessarily babies but -- and they'll pick them up and they'll look particularly at the sawtooth graph and watch it. And they just -- the moms will point out to the little kids, "Watch this." You know it just goes around and around and around. [R128]*

Most respondents pointed out that the *Activity Station* provided good experiences for these younger children.

> *We find a lot of the smaller children up there at the experiment bar. Because we do Carbon Dioxide, and they can do it. We've done Acids and Bases, and they can do that. And the Motors, electromagnetic motors, and Chromatography. So I would say our biggest success for the smaller ones are at that, rather than the stand-up [exhibits]. [R143]*

Many respondents also pointed out that the *Resource Center* worked well for these younger children. Some respondents suggested ways to make it even more useful for this age group.

> *Maybe a few more interactive things....If they can have puzzles that they can put together, or even the book selection. Maybe the book selection could orient itself to kids....Because there's hardly any books over there that would be [appropriate for younger children]. And I know there's a lot of interactive kind of science books and stuff [on the market] for lower elementary. So I guess that's what I would say. If they're going to have this kind of a setting, maybe that would be a place where those younger kids could go. [R143]*

Use by School Groups

School tours seemed to be very important to most of the host institutions in this study. Even the museum that had the *Experiment Gallery* during the summer months was visited by year-round schools from a local district. We were curious to find out the ways in which the host institutions dealt with school groups who came to the *Traveling Experiment Gallery*.

The host institutions developed a variety of approaches to conducting 50 to 60-minute school tours through the *Traveling Experiment Gallery*. Here are four approaches described by our respondents:

- The whole school group would start at the *Activity Station* with a demonstration and discussion of appropriate ways to behave in the exhibition. After the demonstration, the students were turned loose in the exhibition for a period of time. At the end of that time, they all got back together for a group discussion.

- The whole group was turned loose for open-ended exploration of the exhibition, then they would assemble at the *Activity Station* for a demonstration.

- The school group was split into halves. Half the group would start at the *Activity Station* and the other half at the Experiment Benches and other exhibits. Half way through the tour, they would switch.

- Both the exhibition and the school group were divided into quarters. Then the four subgroups were rotated through the four sections of the exhibition. Although the *Activity Station* was not staffed during these tours, a few non-staffed versions of the experiments were set on the counters.

Two of the host institutions did not develop special school tours for the *Traveling Experiment Gallery*. However, school groups were allowed to explore the exhibition on

their own. There were indications that these unscheduled groups sometimes created problems for the floor staff, often related to crowd control around popular exhibits.

Respondents described the important role that the *Traveling Experiment Gallery* seemed to play in supplementing the often meager science laboratories available in local schools.

> *It was a great school accessory. Because a lot of the schools are smaller schools around here and they don't have the lab equipment and stuff that we have here. So when they're discussing things like sound and frequency, they were able to come here and actually demonstrate it. So it was well tied into the curriculum. [R110]*

We understand that the Science Museum of Minnesota provided the host institutions with a Teacher's Guide to the *Traveling Experiment Gallery*. Since there were many indications that school visits were in fact an important aspect of the *Traveling Experiment Gallery* tour, Science Museum of Minnesota might want to consider other ways in which they can support the use of the exhibition by school groups.

Interactions Between Floor Staff and Visitors

From the Staff and Volunteers' Points of View

Working within the inquiry-based philosophy of the *Traveling Experiment Gallery*, floor staff and volunteers were encouraged during training to act as lab assistants and mentors, rather than as traditional docents or demonstrators. They were encouraged to answer visitors' questions, whenever possible, with further questions or with hints about how visitors could find their own answers using the experimental apparatus. We were curious about how well this worked, in practice, given the range of circumstances for staff and volunteer recruitment, training, and supervision.

Here are some of the issues that we uncovered as we observed and talked with floor staff and volunteers.

Giving Explanations vs. Guiding Inquiry.

There were indications that most staff and volunteers tried to engage at least some visitors in inquiry-based learning, although most also regarded giving explanations as an important part of their role. Some personnel spent more time asking questions, and some did more explaining. We saw a range of skills in asking the right questions at the right time (i.e. guiding inquiry).

Guiding to Predetermined Explanations vs. Open Inquiry

Some floor personnel told us that they had to develop good, clear, simple explanations in their own heads before they could ask visitors the right questions. Essentially, in this view, they needed to know where they were going before they could guide visitors there. Of course, this assumes that everyone should wind up in the same place. Other staff and volunteers seemed to be comfortable giving visitors much more control over finding their own explanations. We saw some wonderful examples of this variety of guided learning, especially at the *Activity Station*.

Partisans of both predetermined and open inquiry seemed to agree that "creating questions in visitors minds" was a key part of the process.

Inquiry with Adults and Inquiry with Children

Many staff and volunteers seemed to be more comfortable engaging in inquiry with children. A few said they felt more comfortable doing inquiry with adults, because they felt that adults had a larger base of knowledge to work with.

From the Visitors' Points of View

Visitor reactions to *Activity Station* staff and volunteers seemed to be very positive. There were some indications that visitor reactions to floor staff was somewhat more mixed. Although most groups seemed to appreciate their interactions with staff on the floor, other visitors said they didn't appreciate these interactions. These visitors tended to be in all-adult groups, and there were speculations that adults were intimidated by having their lack-of-knowledge exposed by the inquiry approach (e.g., *The Experiment Gallery Conference Final Report*, 1997). There were also indications that some visitors, who said they would have liked to have interacted with staff or volunteers, didn't realize they were there.

Hierarchies of Inquiry Skills

We've observed floor staff and volunteers as they practiced inquiry with a variety of levels of skill. We've watched both skilled and unskilled personnel succeed and fail in their interactions with visitors. In this section of the report we try to develop a model to help understand why some interactions succeed, and some fail.

In the sections that follow, we define a hierarchy of inquiry skills for floor personnel. This hierarchy ranges from the lower levels (simply giving facts and explanations) to the higher level skills (helping visitors ask their own questions). We also define a parallel hierarchy of inquiry skills for visitors, based on how they respond to their staff/volunteer mentors.

Hierarchy of Inquiry Skills for Floor Personnel

It seems to us that inquiry is a skill that floor personnel have to accept emotionally, understand intellectually, and then practice as a skill.

Based on our discussions and observations with floor personnel, we have defined a hierarchy of inquiry skills for floor personnel. This hierarchy ranges from the lower levels (simply giving facts and explanations), through middle level skills (guiding inquiry by asking appropriate questions), to the higher level skills (helping visitors ask their own questions and re-examine and challenge their own explanations).

In form, the hierarchy parallels the *knowledge hierarchy* described by Deborah Perry in various publications (Perry, 1989; Perry, 1993; Perry & Forland, 1995). Being willing and able to achieve a certain level involves accepting the inquiry philosophy, developing the intellectual and social skills necessary for guiding inquiry at that level, having enough energy to devote to the visitor at hand -- and finding a visitor who is willing to play along.

Level 0 "I don't want to interact with visitors right now." Probably everyone feels like Level 0 from time to time -- hopefully, they either get to go on break or go home!

Level 1 "I'll just answer visitors' questions, giving facts and explanations." This seems to be the "traditional" kind of docent interaction at many museums.

Level 2 "I'll ask the visitors questions, but I'll just request factual knowledge." We saw a few volunteers functioning at this level.

Level 3 "I'll ask questions that help visitors make good observations of the phenomena that I show them." This may be the most appropriate level to work at with younger children.

Level 4 "I'll ask questions that guide visitors towards a pre-determined explanation (whatever answer seems to be appropriate for their age and background)." Level 4 seemed to be achieved by some well trained and well motivated volunteers.

Level 5 "I'll try to help visitors ask better questions so that they can develop their own explanations, even if they disagree with what I consider to be 'correct.' (I'm just the 'coach,' and I have to be accepting of a range of outcomes, as long as the visitors develop them themselves.)"

Level 6 "I'll help visitors ask questions that take them beyond just developing an explanation -- I'll also help them to re-examine and challenge their explanations, and to test them using experiments."

Some staff and a few volunteers seemed to regularly perform at Levels 5 and 6, but there were indications that they also worked at the lower levels when it was appropriate.

Hierarchy of Inquiry Skills for Visitors

Just as for floor personnel, it seems to us that inquiry is a skill that most visitors have to accept emotionally, understand intellectually, and then practice as a skill.

Based on our discussions and observations with visitors, we defined a hierarchy of inquiry skills for visitor. This hierarchy ranges from the lower levels (simply accepting facts and explanations), through middle level skills (accepting guidance by answering appropriate questions), to the higher level skills (asking their own questions and re-examining and challenging their own explanations).

In form, the hierarchy parallels the Hierarchy of Inquiry Skills for Staff and Volunteers. Being willing and able to achieve a certain level involves being open to (or familiar with) this approach, having the intellectual and social skills needed to work at that level, and having enough energy to devote to the task at hand. Previous knowledge of the subject matter, and of science in general, may also help in some circumstances.

Level 0 "Don't bother me!" Probably everyone feels like Level 0 from time to time -- hopefully, they either get to sit down and take a break, or go home At the very least, staff and volunteers should recognize this and leave them alone!

Level 1 "Just answer my questions!" Visitors at Level 0 or Level 1 apparently get annoyed when floor walkers tried to interact at higher levels.

Level 2 "I'll try as best I can to answer your questions about the facts (provided I can remember or guess the answers)." Many visitors were willing to try to function at Level 2 -- it's like a traditional school interaction, after all. Of course, this level of interaction can be very frustrating to visitors when they don't know the answers.

Level 3 "I'll try really hard to make the observations that you suggest (even though it sometimes seems that I have to 'read your mind' to figure out what you want me to say)." Level 3 isn't always as easy as one might think, since visitors sometimes can't guess what the mentor is looking for.

Level 4 "I'll play along with your line of questioning and find out where you are taking me." Some visitors were patient enough to work at Level 4.

Level 5 "I'll try to ask better questions, I'll try not to get frustrated by *your* questions, and I'll try to develop my own explanations."

Level 6 "I'll re-examine the explanations I develop, and try to come up with experiments that will help me decide if they are good explanations."

Levels 5 and 6 were more difficult for many visitors, but skilled staff could take some visitors there. Some visitors, especially parents, also functioned as teachers or mentors, which placed them within the staff-volunteer hierarchy. These visitors sometimes achieved Level 4, but usually interacted at Levels 1, 2, and 3.

Ideally, floor personnel should be able to function well at all levels of their own hierarchy of skills, depending on the situation. This is because the real art in interacting with visitors seems to involve figuring out where the visitor is able to function on the visitor hierarchy, matching that level in the initial encounter, and then gently encouraging the visitor to move up a level or so during the encounter.

A day or two of training wasn't enough to get most volunteers working well at the upper levels of the hierarchy, which is one reason why the continuing modeling and mentoring of supervisory staff can be so important. Our impression was that all staff and volunteers need to continually work not only on their inquiry skills, but also on the art of intuiting the best ways to approach and work with individual visitors.

Filling a Niche at Each Institution

Traveling Experiment Gallery seems to have filled an important niche at each institution on the tour. Sometimes the niche was what we would expect for a traveling exhibition: driving attendance, or gaining publicity for an institution, fulfilling a mission to bring science exhibitions to the area served by the museum, or serving the needs of school groups (e.g., West, 1995). At other institutions, the niche filled by the *Traveling Experiment Gallery* was more unique. At one host institution which was exploring a potential expansion of its role as a science center, *Traveling Experiment Gallery* was viewed as an internal experiment. Some aspects of the experiment related to how well the staff performed their duties related to an interactive physical science exhibit, and other aspects related to the ways in which staff and visitors reacted to the exhibition.

We were particularly interested in cases where the *Traveling Experiment Gallery* made this sort of broader contribution to a host institution's growth and development, because it fits with two of the project goals that we discuss in the following section.

Traveling Experiment Gallery as a Model Exhibition

The National Science Foundation grant proposal for the *Traveling Experiment Gallery* listed two project goals that go beyond providing "merely" a high-quality temporary exhibition for the host institution's visitors:

- To *provide* mid-sized and smaller museums around the country with *a model* of exhibits that encourage visitors to learn about physics through manipulating apparatus, observing phenomena, forming hypotheses, experiments, and drawing conclusions.

- To allow museums around the country to *test the operation of open-ended* Experiment Benches in their own settings and to *evaluate the value of this kind of exhibition* to their visitors and staff.

As we understood it, the original *Experiment Gallery* at Science Museum of Minnesota was, in itself, an experiment in museum learning. It tried to answer the question: Can visitors learn how to *do* science within an informal setting? The core of the *Experiment Gallery* experiment was based on three principles: (a) the process of science, (b) open-ended exhibitry, and (c) an inquiry-based approach to learning. The *Traveling Experiment Gallery*, then, gave host institutions the chance to replicate this experiment-in-learning within their own institutions, to study and interpret the results, and then decide if they want to make changes in their own institution based on what they've learned.

As we talked with staff at the host institutions for the *Traveling Experiment Gallery*, we examined the extent to which host institutions understood and capitalized on this unique opportunity. We realized that most of these institutions were, in one way or another, developing in ways that could benefit from an in-depth consideration of the philosophy and design of the *Traveling Experiment Gallery*. In some cases respondents were quite clear that they also understood the roles that *Traveling Experiment Gallery* could play in their institutional transitions. In a few cases respondents told us of roles that they wished the exhibit could play in their institution, but they despaired that circumstances prevented the institution from acting on what they learned.

Institutions in Transition

Some of the major transitions being undertaken at various host institutions included the following.

- Adding a new wing to the museum, and undertaking an innovative exhibit program as part of that initiative.
- Undertaking a major new program that is intended to expand the museum's offerings into new subject areas of science and new educational philosophies for programming and exhibits.
- Expanding the range of science programming and hands-on science exhibits at an institution.
- Expanding the number of gallery programs and the size of the gallery staff.
- Changing the educational philosophy of gallery programs to an inquiry-based approach to learning.

Of course, some institutions and some departments seemed to lack the budgets, personnel, or power to institute these sorts of changes. However, four of the five host institutions in this study appeared to be implementing plans related to the types of exhibits and programs realized in the *Traveling Experiment Gallery*.

The most powerful forces driving these transitions appeared to be the staff who worked at the institution. In most cases the transitions seem to have been initiated prior to the arrival of the *Traveling Experiment Gallery* by someone within the institution: the executive director or president, a department or division heads, and in some cases a consortium of individuals. When *Experiment Gallery* arrived on the scene, one or more staff recognized its potential for contributing to these transitions and tried to call it to the attention of others on the staff, or to use various aspects of the exhibition as a way to facilitate staff development.

Examples of Traveling Experiment Gallery's Impact

Here is a list of the roles that host staff found for the *Traveling Experiment Gallery* within their institutions. At various institutions, the exhibition:

- Educated staff from a range of departments about inquiry-based and open-ended exhibits and programs.
- Inspired and modeled new approaches to housing and organizing gallery programming in upcoming temporary exhibitions.
- Helped museum educators train gallery staff and volunteers for an expanding effort at gallery programming.
- Allowed museum educators to try out, set the direction for, and train volunteers and staff for a new inquiry-based approach to their gallery programming.
- Educated exhibit maintenance staff about the upkeep of exhibits with large numbers of physical science interactives.
- Educated design and production staff about effective ways to design and build physical science interactives.
- Helped museum educators decide which science equipment to order for incorporation into their existing science programs.

We were interested to note that, although these transitions involved both programming and temporary exhibitions, changes to educational programming dominated the list. It seems that influencing permanent exhibitions may be harder than influencing programming and temporary exhibits.

Missed Opportunities

Of course, many other factors can conspire to limit or at least delay the types of institutional transitions that *Traveling Experiment Gallery* could contribute to. We saw examples of many such factors at work during this study. In some cases natural events like blizzards and floods were beyond any human's control. In other cases dealing with the limiting factors was just another aspect of institutional change. Examples of these sorts of limiting factors included the following.

- Major personnel changes just before, during, or after the run of the *Traveling Experiment Gallery*.
- Administrative decisions that tended to limit some staff's potential interaction with the exhibition.
- Budgetary constraints.
- Staff who didn't seem to completely understand the philosophy behind the *Traveling Experiment Gallery*, and thus never really put it into practice.

- Staff who seemed to understand the basic philosophy behind the *Traveling Experiment Gallery*, but who rejected it for various reasons, or who didn't believe they could learn anything from it.

Here some examples of what we consider to be lost opportunities, where host staff either failed to recognize the potential value of *Traveling Experiment Gallery*, failed to convince themselves and others of its value, or just plain lacked the resources to carry out the changes.

- Exhibit developers and designers for a major exhibition project apparently did not realize that the *Traveling Experiment Gallery* had any lessons that they could learn.

- Program staff at other institutions thought they already understood and accepted the inquiry approach to learning, and hence did not use the opportunity to reexamine and develop their inquiry skills.

- Staff at several institutions said they were inspired and instructed by various aspects of the exhibition, yet they were convinced that it was not within their power to act on these inspirations.

The Meaning of Traveling Experiment Gallery

What was the meaning of the *Traveling Experiment Gallery* to the staff and volunteers at the host institutions? Or, to put it another way, what issues were raised in the minds of host staff as they experienced and discussed *Traveling Experiment Gallery*? Many staff and volunteers seemed to find a range of personal meanings in the exhibition. Added across the host institutions, the range of meanings seemed exceptionally broad.

These personal meanings seemed related to issues raised as respondents compared their own institution's philosophy and exhibitions to *Traveling Experiment Gallery*, and as they contemplated what lessons, if any, the exhibition held for them and their institution. These meanings were much broader than the three core principles of the exhibition (process of science, open-ended exhibitry, and an inquiry-based approach to learning). In some cases respondents' personal meanings may have interfered with their understanding of the *Traveling Experiment Gallery*'s core principles.

The first set of meanings focused on the content and educational philosophy of the *Traveling Experiment Gallery*.

It's About Science. Respondents who discussed this meaning often worked at general museums and especially at museums with a strong historical component. For instance, these respondents mentioned that *Traveling Experiment Gallery* helped them meet their institution's goal of bringing in a few science exhibitions each year.

It's About Physical Science. Respondents who saw this meaning in the exhibit often worked at museums with natural history exhibits.

It's About Making Science Fun. For these respondents, "making science fun" sometimes seemed to stress the entertainment value of the exhibits and activities, and to emphasize passive demonstration at the expense of individual participation.

It's About Getting Comfortable with Science. These respondents sometimes focused on what they saw as the informal or "cozy" aspects of the exhibition. However, other respondents talked about aspects of the exhibit that made them feel uncomfortable, such as the broad array of options at some of the *Experiment Benches* or the subject matter of some of the exhibits and activities (e.g., some respondents said they felt intimidated by having to deal with electric motors).

It's About the Value of "Play." According to some respondents, there was too much play in *Traveling Experiment Gallery*. Other respondents seemed to be concerned that some exhibits were too hard and thus frustrated the visitors' playful natures.

It's About Hands-on Science. It seemed to us that the term "hands-on" was a catch-all phrase for respondents who hadn't given much thought to the range of ways in which visitors could interact with the exhibits.

It's About Interactive Science. Some respondents also used "interactive" as a vague, catch-all phrase. However, other respondents had given much more thought to the components of a "true" interactive experience.

It's About Discovery Learning. Although the term "discovery learning" was not incorporated into the language of *Traveling Experiment Gallery*, some respondents explained the many parallels between their personal philosophies of discovery learning and the learning they saw taking place in the *Traveling Experiment Gallery*.

It's About Engaged Learning. These respondents stressed and valued the extremely high levels of engagement they saw with some visitors.

It's About Letting Visitors Do It On Their Own. Some respondents talked about this approach as something of a revelation. They said they learned this approach during training, and then saw it work on the floor. Other respondents seemed convinced that "let them do it on their own" wasn't necessarily the best approach, since many groups were confused or didn't know what to do, and they really did want some help.

It's About the Processes of Science. These respondents stressed the "experiment" part of the exhibition's title, and also talked about other science process skills such as observing, comparing/contrasting, predicting, hypothesizing, manipulating variables, and developing and evaluating theories.

It's About Inquiry-Based Learning. Most staff and volunteers had something to say about this aspect of the exhibition. Some respondents said they accepted the inquiry approach wholeheartedly, but others had reservations about it.

It's About Open-Ended Exhibitry. Some respondents said they were already familiar with the concept and philosophy of open-endedness, based on their readings in science education and their attendance at national meetings. Other respondents discussed a parallel philosophy about "multi-faceted" exhibits that they had apparently developed on their own.

Some respondents discussed a set of oppositions that they saw around the issues of inquiry and open-endedness. One set of oppositions pitted goal-referenced/content-centered exhibits against open-ended/inquiry-based exhibits. We heard about spirited staff discussions about the range of outcomes that visitors may walk away with in an open-ended exhibition. Many staff seemed to be bothered by the fact that visitors to open-ended exhibits could be developing theories that were "wrong," and relatively few seemed openly

accepting of this fact. Just being exposed to and learning about open-ended, inquiry-based learning doesn't necessarily turn staff members into fans of the method.

The next set of personal meanings seemed less related to the content and educational philosophy of the exhibit, but they were important to some respondents.

It's About the Importance of "Real Objects." Staff who focused on this meaning considered *Traveling Experiment Gallery* to be an exhibit that didn't have any collections objects, such as those commonly exhibited in natural history and anthropology exhibits. These staff seemed to be using *Traveling Experiment Gallery* as a sort of "lightning rod" for issues that they wanted to talk about with other staff. They seemed to be concerned with their institutions' move away from collections-oriented exhibitions, towards interactive-centered exhibitions.

It's About the Value of Context. These respondents talked about providing a natural context within a traditional history or natural history exhibition, as opposed to what some considered to be the out-of-context interactives in *Traveling Experiment Gallery*. Some respondents expressed curiosity about what inquiry and open-endedness might look like in a contexturalized setting.

It's About Production Standards. These respondents wanted to talk about their institution's tradition of highly finished cabinetry or "high tech" looking exhibits, as opposed to *Traveling Experiment Gallery* 's rougher look. Some respondents appreciated the rougher look, and others the more traditional approaches. (Contrast this approach to the design of the exhibit with "It's About Getting Comfortable with Science," above.)

It's About How to Build Durable and Easily Maintained Interactives. Respondents who were involved with design, construction, and maintenance of interactive exhibits had lots of things to say about the ways that the individual exhibits were built.

It's About the Best Way to Write Labels. In part, this issue seemed to be related to the discussion about where an institution should fall on the goal-referenced/content-centered vs. open-ended/inquiry-based continuum. However, there were many other aspects of this issue that staff wanted to discuss, including who should be writing labels, what grade level they should be aiming at, and how long the labels should be.

It might seem that this broad range of potential meanings could interfere the exhibit developers' desire to get host staff thinking about the three basic principles behind the exhibit (the process of science, open-ended exhibitry, and an inquiry-based approach to learning). This certainly seemed true for respondents whose main goal was to make science fun, or who were disturbed and distracted by the design, or frustrated by way the labels were written. These respondents had not given much thought to the three basic principles behind the *Traveling Experiment Gallery*.

On the other hand, respondents who seemed to have thought most deeply about science process, open-endedness, and inquiry also seemed interested in discussing a broad range of other meanings for the exhibit. These alternative meanings seemed to enrich their understanding of the *Traveling Experiment Gallery*.

Planning for Influence

As we've discussed, *Traveling Experiment Gallery* seemed to influence change within an institution when one or more staff members recognized its potential for contributing to transitions that had been initiated before the exhibit arrived on the scene. If Science Museum of Minnesota's staff want to maximize the *Traveling Experiment Gallery*'s influence within future host institutions, then one strategy could include the following steps (based in large part on Denver's *Experiment Gallery* conference).

- Get to know some staff at the institution, possibly through contacts related to the logistics of the exhibition.

- Find out what transitions are taking place within the host institution and which staff seem to be driving those changes.

- Contact one or more of those key staff and initiate a discussion about the philosophies behind the *Traveling Experiment Gallery*. If appropriate, consider mentioning the experiences of staff at some of the earlier host institutions (e.g., Denver Museum of Natural History).

- Try to arrange for some informal discussion sessions with the museum's staff during the set-up and training period for the exhibition.

At some institutions, only a small percentage of the staff are directly involved with temporary exhibits and gallery programs. When arranging for these discussion sessions, Science Museum of Minnesota staff should consider ways to involve other staff at these institutions, including:

- Educators who are not involved in gallery programs or in tours through traveling exhibitions.

- Designers and exhibit developers who work on permanent exhibitions.

- Educators who specialize in social sciences or art, but who can still learn from inquiry-based and open-ended exhibits and programs.

- Research and collections staff, who are often involved in and committed to both the exhibits and education programs at their institutions.

The goals of these sessions wouldn't necessarily be to "sell" the concepts behind the *Traveling Experiment Gallery*. Rather, they could be much more open-ended.

- Encourage host staff to reflect on what they have been, are, and will be doing in regards to process-oriented, inquiry-based, and open-ended exhibits and programs.

- Listen to host staff as they talk about *their* versions of their future -- what they *could* be doing, and why they are consider doing it.

- Encourage host staff to consider their own institution's goals and plans as they look at and interact with the exhibits in the *Traveling Experiment Gallery*.

- Encourage host staff to spend time with visitors in the *Traveling Experiment Gallery* over the next three months.

- Encourage host staff meet again in two or three months to discuss their experiences.

As with any other open-ended experience, one should expect a range of outcomes from this sort of exercise. Based on the experiences at the earlier host institutions, staff discussions of the *Traveling Experiment Gallery* could have some (or all) of the following outcomes.

- Validate the *status quo*. ("We're already doing inquiry, and the *Traveling Experiment Gallery* makes us feel better about what we've accomplished.")

- Spread an existing philosophy across boundaries within an institution. ("We've been doing inquiry in my division, now here's my opportunity to show other staff what inquiry is all about.")

- Extend an existing philosophy into new subject areas. ("We've been doing inquiry in our history programs, now let's try it in our science programs.")

- Help staff put into practice an approach that they only had been thinking about up until now. ("I've heard about inquiry, now I want to try it myself.")

- Allow the opposition to solidify its opposition. ("I always suspected that inquiry was a bad idea, and now I have the evidence to prove it!")

- Take the institution in a completely new direction. ("We've never thought about the inquiry approach before, and now that we've tried it....")

Working with Different Institutions

All of the issues discussed above could be affected by the size and type of museum or science center that serves as host institution. For instance, larger museums may have larger staff and volunteer pools from which they can draw the human resources necessary to meet the staffing requirements for this exhibit. Museums with trained science educators on staff may be better prepared to understand and accept the educational philosophy of the *Traveling Experiment Gallery*.

Some respondents from smaller institutions expressed concern that the Science Museum of Minnesota was not fully accepting of the needs and limitations of the smaller museums on the tour.

> *I don't know where this thing is going onto. Maybe we're the smallest museum that exhibit is ever going to go to. But they might want to keep in mind ways of making it flexible for all sizes of museums....The exhibit needs to be flexible enough to be able to work with the amount of staff that we have....I mean, personally, I thought it was a great exhibit to bring in here. But we needed to have some flexibility to...make it work for us. And we did have that essentially. But I got the feeling like [some people weren't] really happy with it. [Other people] didn't seem to have a problem with it. [R110]*

There were indications that Science Museum of Minnesota staff were realizing the value of increased flexibility when dealing with these smaller institutions. Here's what one respondent at the Science Museum had to say.

We're finding out that one of the things about the exhibit is there is a certain amount of flexibility built in and I think people are taking advantage of that. You know. It would be nice to know -- to what effect you know and to what -- what does it take away from the exhibit? What does it lend maybe? [R111]

RECOMMENDATIONS

Promotional Materials and Initial Expectations

- Send out promotional materials that clearly indicate staffing requirements, costs associated with running the gallery, and maintenance requirements.

- Expand these materials to include suggestions on recruiting volunteer floor personnel, aimed especially at smaller institutions. (This point is further discussed later in this section.)

- Follow up on these promotional materials with phone calls to both exhibit and program staff at the host institutions.

- Encourage staff from prospective host institutions to visit *Traveling Experiment Gallery* prior to its arrival at their own institution. (Any future grant proposals might include travel funds for staff from small museums.)

Public Relations Materials Provided to Host Institutions

- Send public relations materials out in plenty of time for the host institutions to distribute them.

Size of the Exhibit Space and Configuration of Components

- Because the *Traveling Experiment Gallery* has worked well in a range of gallery sizes, the Science Museum of Minnesota should continue to be flexible about the recommended square footage of the installation.

- When designing the floor plan for a particularly large gallery, be aware of the negative impacts that "dark corners" have had on both staff and visitor perceptions of the exhibition.

- For gallery spaces that are less than 2,500 square feet it may be necessary to drop certain exhibit units from the floor plan. When working with host staff to decide which units to leave out, remember that the *Resource Center* seems to be serving important functions as a rest stop and as an activity area for families with young children.

- Whenever possible, situate the *Activity Station* so that it faces the main entrance of the gallery space. This can help maximize its role as an orientation to the rest of the exhibit.

Maintenance Support

- Continue the best practices cited earlier in this report.

- In so far as possible, continue to use experienced Science Museum of Minnesota staff for the support functions, and especially for staff training in *Traveling Experiment Gallery* maintenance.

Activity Station

- When working with host staff to arrange for the staffing of this area, emphasize the important role that this area has played in the visitor experience at other venues. Assure them that evaluation studies indicate that developing an effective plan for staffing this area will be well worth their effort and expense.

- As part of the training for floor staff and volunteers, make them aware of the important role that this part of the exhibit plays for families with young children. Encourage them to help visitors with young children find and use this area.

Resource Area

- As part of the training for floor staff and volunteers, make them aware of the important roles that the *Resource Area* plays for visitors (rest stop, area for young children, and information source). Encourage them to help visitors with young children find and use this area.

- Increase the number of books and activities aimed primarily at younger children (preschool through second grade).

- Also during training, make sure that the floor staff and volunteers recognize that the *Resource Area* can play an important role in their own continuing training.

- Consider adding resources (books and videos) that can make the *Resource Center* an even more effective resource for staff and volunteers.

Experiment Benches and Other Exhibits

- The Science Museum of Minnesota should continue to regard the labels on these interactives as works in progress. Revisions made to labels during the reinstallation of the original *Experiment Gallery* should be reflected in the labels on the traveling version of this exhibition.

Physical Safety of Visitors and Staff

- Continue to help host staff develop realistic perspectives on the safety of the *Traveling Experiment Gallery* exhibits and programs. As discussed earlier in this report, this seems to require a combination of education during the set-up period and training sessions and first-hand experience with the exhibit. If at all possible, some of this first-hand experience should come during visits to the *Traveling Experiment Gallery* at an earlier venue on the tour.

- Training for the *Activity Station* should continue to stress the safety of both staff and visitors.

Staffing the *Traveling Experiment Gallery*

Recruiting Floor Staff and Volunteers

- Provide prospective hosts with a range of suggestions for finding and recruiting both floor staff and volunteers for the *Traveling Experiment Gallery*.

- Consider whether to provide prospective hosts with written materials that can help them "sell" this volunteer experience to their existing corps of volunteer docents or explainers. (But, also consider the following point.)

- Consider what sorts of qualifications are important for prospective floor staff and volunteers, and then provide a list those qualifications to the prospective host institutions. Among other things, it might be wise to discuss ways in which a host institution's existing corps of volunteers may or may not be a suitable source for *Experiment Gallery* volunteers. It might also be wise to suggest that floor staff have previous exposure to inquiry-based learning, either through college coursework or teaching experience.

- The Science Museum of Minnesota has a wealth of experience with teenage floor personnel in the original *Experiment Gallery*. Find ways to share this experience with prospective host institutions. For instance, what should the hosts plan on doing differently if they recruit teenage volunteers?

Training Floor Staff and Volunteers

- The Science Museum of Minnesota trainers should work hand-in-hand with their counter-parts at the host institutions to set the goals for the training session, in addition to arranging for the logistics for the training. In particular, the Minnesota staff should try to understand and adapt to the host staff's backgrounds and philosophies relative to process-oriented, open-ended, and inquiry-based learning.

- Whenever possible, staff should be trained separately from and prior to the volunteers. Although volunteer training may be appropriately basic at most host institutions, staff training may vary widely from institution to institution, depending on the backgrounds and philosophies of the host staff.

- Provide training materials, similar to *Let's Try It...*, that both explain the Experiment Benches and related exhibits and give suggestions about how to help visitors understand and work with these exhibits.

- Help floor personnel realize that a successful inquiry experience requires a good match between their choice of levels on the inquiry hierarchy and the levels at which the visitor is willing and able to respond.

Continuing Support for Floor Staff and Volunteers

- Help the host institutions develop plans for continuing support, mentoring, and training for their floor staff and volunteers throughout the run of the *Traveling Experiment Gallery*.

- Develop materials and exercises that can help the hosts provide this support.

- Encourage floor staff to act as inquiry mentors and models for their volunteers.

- Encourage staff and volunteers to share their experiences with each other.

Use by Young Children and Their Families

- Find ways to support and improve the use of the *Activity Station* and *Resource Center* by families with young children.

Use by School Groups

- Develop additional support materials for the host institutions that can help them improve the use of the *Traveling Experiment Gallery* by school groups.

Traveling Experiment Gallery as a Model Exhibition

- Encourage staff at the host institutions to think reflectively about what role *Traveling Experiment Gallery* might play for them. As discussed earlier in this report, find ways to encourage them to:
    - Recognize *Traveling Experiment Gallery* as an experiment within their own institution.
    - Discuss what they might be able to learn from their experience with the exhibition.
    - Send all kinds of staff members into the exhibition to watch visitors.
    - Arrange for staff meetings where a wide range of staff can discuss and reflect on their experiences.

- Recognize that the exhibit technician who sets up the *Traveling Experiment Gallery* and trains host staff in its maintenance also plays a critical role in teaching host staff about the design and construction of open-ended interactives. Consider developing printed materials that can support this aspect of training.

REFERENCES CITED

The Experiment Gallery Conference Final Report. (1997). Unpublished monograph. Denver, Colorado: Denver Museum of Natural History.

Faulkner, S. M. (1997). Maximizing the Stated Purpose of a Museum Through Exhibit Evaluation: An Exploratory Study. Unpublished monograph. Waco, Texas: Baylor University, Department of Museum Studies.

Perry, D. L. (1989). The creation and verification of a development model for the design of a museum exhibit. *Dissertation Abstracts International*, *50*, 12A, (University Microfilms No. 90-12186).

Perry, D. L. (1993). Measuring learning with the knowledge hierarchy. In A. Benefield, S. Bitgood, H. Shettel, D. Thompson, R. Williams (Eds.), *Visitor Studies: Theory, research, and practice, Volume 6, Proceedings of the 1993 Visitor Studies Conference*. Jacksonville, Alabama: Center for Social Design.

Perry, D. L. (1994). *Experiment Benches Summative Evaluation Report*. Unpublished monograph. St. Paul, Minnesota: Science Museum of Minnesota

Perry, D. L. & Forland, E. (1995). *The Exploration Zone at the Field Museum: Front End Evaluation*. Unpublished monograph. Chicago, Illinois: The Field Museum.

West, R. M. (September/October, 1995). Impact and importance of traveling exhibitions. *The Informal Science Review,* No. 14: 14-15.

APPENDIX A: *Traveling Experiment Gallery* Topical Framework

1. Description of the Host Sites
    a. size, operating budget, visitorship
    b. organizational structure, departments, roles of departments
    c. museum culture
    d. how exhibitions are developed, designed, built
    e. gallery programs
2. Operational Issues
    a. cost
    b. Science Museum of Minnesota maintenance and support
    c. hosts' maintenance responsibilities
    d. training and staffing
    e. promotion and public relations
    f. set-up
    g. safety
3. Perceptions of Visitors' Experiences in *Traveling Experiment Gallery*
    a. where visitors spend time
    b. interactions with floor staff
    c. learning and enjoyment
    d. younger children and school groups
    e. comment books, evaluations, etc.
4. *Traveling Experiment Gallery* and the Host Institutions
    a. perception of *Traveling Experiment Gallery* as a different type of exhibition
    b. perceptions of process-oriented, open-ended, inquiry-based exhibits
    c. perceptions of visitor learning, play, and related issues
    d. how *Traveling Experiment Gallery* fit in/did not fit in with the host institutions
    e. long-term influences/integration
5. Overall Perceived Success or Non-success of the Exhibit.
    a. *Resource Area*
    b. *Activity Station*
    c. Experiment Benches
    d. other exhibits
    e. labels
    f. lessons learned
    g. comparison to other traveling exhibits

APPENDIX B: Summary of the Data

Science Place				
Date	(person-hours)		Staff Interviews	
3/6/97	3.5		1	
3/11/97	3.5		1	
TOTAL	*7*		*2*	

Heritage-Hjemkomst Interpretive Center				
Date	(person-hours)		Staff Interviews	
5/1/97	3.5		1	
5/22/97	3.5		1	
TOTAL	*7*		*2*	

Denver Museum of Natural History							
		Visitors Unobtrusive Observations		Visitors Depth Interviews		Staff	Volunteer
Date	(person-hours)	groups	individuals	groups	individuals	Interviews	Interviews
6/3/97	1					1	
6/27/97	16					4	
6/28/1997*	10	3	5	3	4	1	1
6/29/97	7	3	9	3	6	1	3
8/29/97	3					1	
10/29/97	1					1	
7/5/98	1					1	
TOTAL	*39*	*6*	*14*	*6*	*10*	*10*	*4*

* In addition, we conducted a group debrief session with 10 volunteers who were helping with the in-house evaluation of the exhibition.

Cranbrook Institute of Science							
		Visitors Unobtrusive Observations		Visitors Depth Interviews		Staff	Volunteer
Date	(person-hours)	groups	individuals	groups	individuals	Interviews	Interviews
11/24/97	2					1	
12/12/97	10					4	1
12/13/97	10	4	18	4	8	1	1
12/14/97	5	2	6	2	3	1	
12/18/97	1					1	
TOTAL	*28*	*6*	*24*	*6*	*11*	*8*	*2*

APPENDIX B: Summary of the Data, continued

Sloan Museum							
		Visitors Unobtrusive Observations		Visitors Depth Interviews		Staff	Volunteer
Date	(person-hours)	groups	individuals	groups	individuals	Interviews	Interviews
4/9/98	3					1	
4/13/98	3					1	
4/17/98	9					4	
4/18/98	9	4	17	4	11	1	
4/19/98	4					1	
TOTAL	*28*	*4*	*17*	*4*	*11*	*8*	*0*

GRAND TOTALS							
		Visitors Unobtrusive Observations		Visitors Depth Interviews		Staff	Volunteer
	(person-hours)	groups	individuals	groups	individuals	Interviews	Interviews
	109	**16**	**55**	**16**	**32**	**30**	**6**