



**Impact Planning, Evaluation & Audience Research**

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**Community of Learners Impact Study:  
*Mammoth Discovery!***

*Prepared for the*  
**Children's Discovery Museum**  
**San Jose, CA**

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# SUMMARY

## INTRODUCTION

This report presents the findings from the Community of Learners impact study conducted by Randi Korn & Associates, Inc. (RK&A) for the Children's Discovery Museum (CDM). This project is part of a larger exhibition development and research project funded by the National Science Foundation. RK&A conducted this evaluation to measure the impact of the *Mammoth Discovery!* project on informal science education professional practice on representatives from three children's museums (Austin Children's Museum, Madison Children's Museum and Providence Children's Museum). Data for this evaluation were collected through observations, reflection papers, and in-depth interviews over the course of the project between 2009 and 2012. The summary below, which highlights key findings, is organized around the impacts identified in the proposal submitted to the NSF (see Table i below).

**Selected highlights of the study are included in this summary.  
Please consult the body of the report for a detailed account of the findings.**

## DISCUSSION

This study reveals many benefits of professional development for museum professionals, and overall, this program was very successful in meeting its intended impacts (see Table I). In addition, attaching the professional development program to an innovative project (the development of *Mammoth Discovery!*) furthers the ISE profession by sharing knowledge, expertise, and experience among colleagues from different institutions across the country. This type of professional development project is unique compared to other professional development initiatives because it involved the same people meeting repeatedly over a long period of time who were focused on a particular project. This structure allowed people to deepen their trust in each other and understand the project and their own reflections. Further, the professional development piece filled a real need among museum practitioners: it offered professional development with like-minded individuals who could pursue learning together; it provided face-time with researchers and scientists who were generous with their time following the formal meetings; and it provided a model of how a research-museum partnership functions.

The professional development program focused on three areas – evaluation, prototyping, and research partnerships – and participants found value in and learned a lot from all of these areas. All participants mentioned that they found a number of things useful and either plan to or are already applying new information to their practice.

**TABLE I****ACHIEVEMENT OF OBJECTIVES**

<b>COMMUNITY OF LEARNERS</b>	
Participants will become aware of alternate exhibit development practice (e.g. prototyping)	Yes
Participants will understand the potential impact of research on exhibit development for children	Yes
Participants will perceive the benefits from participation in scientific dialogue	Yes
<b>MUSEUM-RESEARCH PARTNERSHIPS</b>	
Participants will gain interest in establishing research partnerships	Yes
Participants will understand the benefits of research partnerships	Yes
Participants will learn to apply museum research to their practice	Yes
<b>EVIDENCE-BASED REASONING AMONG CHILDREN</b>	
Participants will gain awareness of evidence-based experiences for children in museum settings	Yes
Participants will engage in dialogue about research on children's reasoning with evidence	Yes
Participants will learn to apply information about children's reasoning with evidence to exhibits and programs	Somewhat

**COMMUNITY OF LEARNERS**

The reflections and experiences of the participants showed that museum professionals are life-long learners and this program tapped into the professionals' innate desire to learn. Further, the community element of their learning proved to be very successful both in terms of sharing knowledge as well as creating a supportive environment that brought a sense of pride to the participants' own work and led to new connections and relationships that will likely continue beyond this program (see quotation below).

The impact of participating in *Mammoth Discovery!* has been so much richer and deeper than any other professional development activities our staff has taken part in. I can already see that it has elevated our expectations of what is possible in a science-focused children's museum to a higher level. And it has also given us the tools to achieve many of those expectations.

Participants were very impressed by CDM's practices and viewed CDM as a leader in the field. Participants particularly appreciated learning about CDM's rigorous prototyping process, which informed their own practice around exhibit development. They became aware of how both research

and the articulation of intended impacts<sup>1</sup> at the beginning of a project benefits exhibit development during the early phases. Though participants generally felt that they were not quite ready to be as rigorous as CDM, they saw that incorporating some aspects of prototyping was a necessary step in developing exhibits (see the quotation below).

Insight into the goals and implementation of CDM's prototyping process was extremely informative and inspirational. We continue to applaud both their rigorous dedication to refining exhibit experiences to achieve intended impacts. . . .

### MUSEUM-RESEARCH PARTNERSHIPS

All participants were very excited to learn about CDM's partnership with a local learning researcher. Participants appreciated learning about the benefits of this type of partnership, how to create such a partnership at their own institution, and how to sustain and make such a partnership mutually beneficial. Participants valued being able to see CDM's partnership as a model, learn what both partners bring to a project and to learn directly from the learning researcher herself. Since the beginning of this program, all three cohort museums are currently involved in such partnerships with local learning researchers in their home towns and are aiming to further improve these partnerships. Participants also expressed much interest in the potential for a collaborative museum-research project across the three museums.

### EVIDENCE-BASED REASONING AMONG CHILDREN

Participants viewed the focus on evidence and other science process skills within this exhibition as quite unique and challenging yet a worthwhile approach. Through the course of this project, participants were able to learn from a leading learning researcher about empirical research on children's evidence-based reasoning. In addition, many participants learned useful and innovative ways to approach science content, as in *Mammoth Discovery!* Such innovative ideas included the use of narrative and the local focus, taking into account children's experiences and applying those ideas to science experiences in their museums (see the quotation below).

I applaud CDM's decision to take a more intelligent, process-oriented approach to the topic at hand than has been seen in many children's museum paleontology exhibits. The opportunity to incorporate actual prehistoric bones (authenticity!) and tell the story of the local discovery (personal connection!) would probably be enough to score a sure-fire hit with the legions of preschool paleontology experts. Instead, CDM chose to aim higher by expanding its academic partnerships to advance research about the development of scientific reasoning and take on the challenge of creating an exhibit that is transparent in its focus on thinking skills.

In summary, the professional development aspect of *Mammoth Discovery!* demonstrates that recipients of grant-funded initiatives are eager to further their own personal learning and enhance their organization's professionalism. Forming a community where practitioners learn together creates life-long opportunities for further learning and fosters alliances that are synergistic in their ability to improve ISE across institutions.

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<sup>1</sup> Participants found much utility to their practice in learning from RK&A how to write impact statements and that these impact statements can serve both the planning and evaluation processes. Participants reported that since learning how to craft impact statements, they started incorporating them into their planning work. They also valued learning about rubrics and ways to measure their intended impacts.

## **SPEAKING TO THE STATE-OF-THE-PROFESSION STUDY: SCIENCE IN CHILDREN'S MUSEUMS**

At the beginning of the *Mammoth Discovery!* project, RK&A conducted a study to investigate the current state of professional practice in developing and implementing science exhibits at children's museums. Overall, this study described the prevalence of science experiences in children's museums, the process behind the development of these experiences, the capacity for developing these experiences and the challenges they face doing so, and perceptions of science and doing science in children's museums. In response to that initial survey of the field, and in light of the promising findings from the professional development piece of this project with the formation of this community of learners, there is potential to address deficits and challenges that children's museums face in offering science experiences. A few challenges that emerged in the initial survey that this professional development project addressed include:

- ◆ Most respondents in the State of the Profession study said that their institution offers some type of science exhibit for their visitors. However, how institutions do science varies. Whereas science exhibits in children's museums were generally designed for open-ended exploration or using science-process skills, relatively few children's museums offered science experiences that incorporated using evidence to draw conclusions though this was viewed as an important aspect of science in general. Through the course of the professional development project, participants had the opportunity to explore evidence more closely through conversations about research on children's reasoning with evidence. The results of this study show that participants' expectations about the type of science experiences they can create in children's museums were heightened;
- ◆ Few respondents in the State of the Profession study reported partnering with a learning or content university researcher. This professional development project has pinpointed potential reasons why such partnerships may be uncommon, including that museum practitioners are unaware of the benefits of these types of partnerships and how to initiate and sustain such partnerships. Through the course of this project, participants experienced firsthand how such partnerships work and what each partner might gain from the experience. Notably, all participants have become involved in a research partnership with a local university researcher.
- ◆ In the State of the Professions study, lack of funding for developing science exhibits was identified as a primary challenge. Further, only some reported that their institution had ever applied for an NSF Informal Science Education (ISE) grant because their "museum is small and unlikely to win NSF funds" and "it is too complicated to apply for NSF funds." In this professional development project, participants had the opportunity to learn and participate in discussions about the NSF ISE proposal-writing process from the articulation of the intended impacts of the exhibition, to developing the exhibition to meet those impacts, to evaluating how well the exhibition met those impacts, to the impact the larger project has in the ISE field.

## **RECOMMENDATION FOR THE ISE FIELD**

Further funding of more of these types of projects can advance the ISE field for the following reasons:

- ❖ This kind of professional development project fills a need: museum practitioners, like most adult learners, have an innate desire to learn and improve their practice and become a community of learners. The success of this project lies in its structure: in contrast to the usual one time professional development workshop, the opportunity for repeated meetings

- of the same people over time creates a deep educational and rewarding experience for all those involved.
- ❖ This project demonstrates that museum practitioners can benefit from receiving mentoring to develop science exhibits. Participation in this type of professional development stretched practitioners' expectations concerning what an exhibit can do for young children; in particular, participants were surprised to learn that it is possible to develop process-based science skills such as evidence-based experiences for children.
  - ❖ Participants' responsiveness to this project identifies another need in the ISE field: practitioners need to both learn about how to develop a research partnership and how to sustain such partnerships.
  - ❖ Participation in this project connected museum practitioners to other experts in the museum field and related fields and enabled participants to become aware of and connected to the vast network of resources that CDM created over the years, thereby making these various knowledge pockets available to others as they continue their work.

# INTRODUCTION

The Children’s Discovery Museum of San Jose (CDM) contracted Randi Korn & Associates, Inc. (RK&A) to study the professional development component of the *Mammoth Discovery!* project, which involved a community of learners consisting of museum professionals (cohort<sup>2</sup> participants) from a select group of children’s museums (cohort museums including Austin Children’s Museum, Madison Children’s Museum and Providence Children’s Museum). RK&A conducted this study, funded by the National Science Foundation (NSF), to measure the impact of this project on the professional practice of these museum practitioners.

## BACKGROUND INFORMATION

As part of the *Mammoth Discovery!* project CDM initiated a number of different types of partnerships in the development of this exhibition. Primary partners for this project included content specialists at the University of California, Berkeley, Museum of Paleontology and learning researchers at the University of California, Santa Cruz. Additionally, CDM selected three museums as collaborators that would meet as a community of learners at different points during the course of the project.

Two staff each from the CDM-selected cohort museums participated in yearly professional development workshops, developed and conducted by CDM staff, and also gathered together a number of times at the Association of Children’s Museums (ACM) conference. The yearly workshops were also attended by the content and learning researchers as well as an evaluator from RK&A. Each workshop focused on a different topic that was instrumental in the development of the exhibition and provided a larger context for professional development for the cohort participants and their museums. The first workshop, facilitated by RK&A, focused on the entire group brainstorming and then writing intended impacts for the project, which served as planning guideposts for exhibit developers and evaluation guideposts for the evaluators. The second workshop focused on the project’s academic partners. Cohort participants had the opportunity to learn about the work of these researchers and to further understand how these types of partnerships work. The third workshop gave participants an opportunity to see the final exhibition, revisit the impacts of the exhibition, learn about preliminary research findings, and reflect as a group on their experience in the professional development program. In addition to the core six cohort participants, one or two additional staff from the cohort museums attended the third workshop.

This impact study examines the professional development program from the perspectives of cohort museum staff at various times throughout the course of this grant. The core cohort museum staff included:

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<sup>2</sup> CDM selected three museums as collaborators; we refer to these museums as “cohort” museums and the individual practitioners who attended these workshops as “cohort” participants.



## COHORT MUSEUM STAFF

- ◆ Janice O'Donnell, Executive Director, Providence Children's Museum;
- ◆ Carly Baumann, Education Programs Coordinator, Providence Children's Museum;
- ◆ Ruth Shelly, Executive Director, Madison Children's Museum;
- ◆ Kia Karlen, Director of Education, Madison Children's Museum;
- ◆ Rebecca Jones, Director of Education, Austin Children's Museum; and
- ◆ Christina Soontornvat, Science Content Developer, Austin Children's Museum.

## ADDITIONAL COHORT MUSEUM STAFF AT THE THIRD WORKSHOP

- ◆ Robin Meisner, Director of Exhibits, Providence Children's Museum;
- ◆ Brenda Baker, Exhibits Director, Madison Children's Museum;
- ◆ John Robinson, Exhibits Developer, Madison Children's Museum; and
- ◆ Matt Stalberger, Exhibits Manager, Austin Children's Museum.

## OBJECTIVES

Specifically, this impact study was designed to:

- ◆ Examine the overall experiences of children's museum professionals as participants in a community of learners including their:
  - ❖ Awareness of alternate exhibit development practice (e.g. prototyping);
  - ❖ Understanding of the potential impact of research on exhibit development for children; and
  - ❖ Perceived benefits from participation in scientific dialogue.
- ◆ Examine the overall experiences of children's museum professionals learning about museum-research partnerships including their:
  - ❖ Interest in establishing research partnerships;
  - ❖ Understanding of the benefits of research partnerships; and
  - ❖ Application of museum research to their practice.
- ◆ Determine the degree to which children's museum professionals gain knowledge about how children reason with evidence including their:
  - ❖ Awareness of evidence-based experiences for children in museum settings;
  - ❖ Engagement in dialogue about research on children's reasoning with evidence; and
  - ❖ Application of information about children's reasoning with evidence to exhibits and programs.

## METHODOLOGY AND DATA ANALYSIS

RK&A used three data collection strategies to examine the impact of the community of learners on cohort participants: reflection papers, in-depth interviews, and cohort workshop observations. All data were collected between April 2009 and January 2012.

### REFLECTION PAPERS

Reflection papers were selected for use in this study to invite cohort participants to share insights about their workshop experiences and in the project overall. Specifically, the reflection papers provided an opportunity for participants to process ideas and share how they are or will be implementing what they learned at their home institutions.

Cohort participants were asked to write three reflection papers, following the prompts provided in Appendix A, writing one paper after each of the three workshops held at CDM. In addition, a third (and in one case a fourth) member from each institution who was present at the third workshop was also asked to write a reflection paper following their experience.

### IN-DEPTH INTERVIEWS

In-depth interviews were used to examine the impact of the professional development component of *Mammoth Discovery!* from the perspectives of cohort museum staff. In-depth interviews encourage people to describe their experiences, express their opinions and feelings, and share with the interviewer the meaning they construct from an experience. In-depth interviews produce data rich in information because interviewees talk about personal experiences, and they complement and further contextualize data collected in the reflection papers and workshop observations. Cohort participant interviews at the start of this project (phase one)<sup>3</sup> combined with the second round of interviews (phase two) provide a holistic picture of staff members' experiences in this project.

RK&A conducted in-depth interviews via telephone with the six cohort participants (two staff each from the three museums). RK&A conducted the interviews using a separate interview guide for the first and last interviews (see Appendices B and C). All interviews were audio recorded with interviewees' consent and transcribed to facilitate analysis.

### COHORT WORKSHOP OBSERVATIONS

The evaluator attended and was a participant observer in the third workshop. These observations provide a picture of what participation in this community of learners actually entailed including how the workshop was structured, what discussions emerged, and what role each participant played in the larger group.

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<sup>3</sup> These initial interviews were conducted and analyzed as part of the State of the Profession report, which was Phase One of the overall *Mammoth Discovery!* project. These initial interviews provided qualitative data to complement the state of the profession survey. They are referred to here since some questions from this initial interview pertain specifically to participants' expectations about their involvement in this cohort. As such, participants' responses in the first interview to these questions will be analyzed to give context to their motivations and expectations going into this professional development group and provide a point of comparison with the reflections participants have on what they actually gained from their involvement as discussed in the second round of interviews.

## **DATA ANALYSIS**

The data are qualitative, meaning that results are descriptive. In analyzing the data, the evaluator separately studies her own observation notes of the workshop, the reflection papers, and the transcripts for the two phases of interviews. As patterns and trends emerged, similar responses eliciting trends in the data were grouped together.

## **REPORTING METHOD**

Findings from each methodology are presented in separate sections. The data are presented in narrative and with verbatim quotations (edited for clarity). For quotations, the interviewer's remarks appear in parentheses. The quotations are not attributed to specific speakers to uphold the confidentiality and anonymity agreement with interviewees. Trends and themes in the data also are presented from most-to least-frequently occurring. The objectives of the study informed the analysis.

### **SECTIONS OF THE REPORT:**

1. Reflection Papers
2. In-depth Interviews
3. Cohort Workshop Observations

# PRINCIPAL FINDINGS: REFLECTION PAPERS

## INTRODUCTION

Cohort participants were asked to write a reflection paper, following the same provided prompts, after the three workshops held at CDM to examine the professional development component of this project. One or two additional staff members from the cohort museums who attended the third workshop were asked to write a reflection paper after their workshop attendance. Reflection papers were completed and sent electronically each year from 2009 – 2011<sup>4</sup> for the core cohort participants<sup>5</sup> and in 2011 for the additional staff members.

## OVERALL EXPERIENCE

Overall, all participants (core participants and additional staff who attended the third workshop) reflected very positively on their participation in this project. Participants said that they gained much from being part of a community of learners (see first quotation below). They appreciated the opportunity to see the project throughout its course, the openness the group developed in sharing their experiences, and the true community spirit that grew (see second quotation below). Almost all participants expressed high regard for the CDM team, its role in creating the community and the rigorous work that it does. Many participants mentioned having a feeling of accomplishment in seeing the final exhibition. Some participants mentioned that the relationships they built through their participation would continue into the future.

The impact of participating in *Mammoth Discovery!* has been so much richer and deeper than any other professional development activities our staff has taken part in. I can already see that it has elevated our expectations of what is possible in a science-focused children's museum to a higher level. And it has also given us the tools to achieve many of those expectations.

Throughout the preceding workshops, CDM staff, project consultants and cohort museum participants have been a collegial group, demonstrating a generous willingness and sincere interest in sharing expertise, experience and perspectives. Clearly, each time we've convened there has been a higher level of familiarity by virtue of the cumulative time spent together. Of all the meetings, but somehow this workshop seemed to me to achieve for the first time the tenor of a learning community. Perhaps it was because there was a well-deserved congratulatory air of accomplishment in being witness to production of such a beautiful, well-done exhibit. Or perhaps it was in the particular mix of cohort attendees that happened to provide me a long overdue reunion with highly respected colleagues with whom a close bond had formed over the course of a multi-year exhibit consortium project. Nevertheless, Jenni, Sara, Steve and other CDM staff deserve high praise for setting a tone of generosity, openness and a truly inspiring dedication to excellence.

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<sup>4</sup> Most reflection papers after the third workshop, which took place in December 2011, were written and submitted in January 2012.

<sup>5</sup> These data do not include the reflection papers of one cohort participant who did attend all of the workshops. Another cohort participant who did not attend the second workshop did not complete her second reflection paper.

## NEW KNOWLEDGE AND UTILITY FOR OWN PRACTICE

Participants were asked to identify which aspects of the workshops, including tools and ideas, they found most useful and if and how those aspects might affect their own practice. All participants mentioned that they found a number of things useful and either plan to or are already applying new information to their practice. All of the core cohort participants and most of the additional staff mentioned learning a lot about research partnerships through the course of the project. Participants mentioned learning about what a museum/research partnership could look like in practice and becoming aware of its value. Most participants viewed the type of partnership that CDM has with UCSC as a model of a mutually beneficial relationship that they hope to create. Participants appreciated being able to discuss their goals of having such a partnership and the challenges they faced with the UCSC researcher as well as with the other cohort museums. They said that they received a lot of practical advice on the logistics of initiating such a partnership and how to navigate some of the communication problems they faced. A participant from one museum, who has had a long-standing relationship with a local researcher, said that her experience on this project has already affected her current partnership and will also affect future partnerships her museum creates. Participants from a second museum mentioned that the researcher from UCSC introduced her museum to a local and interested researcher and they are already working on a collaborative project. One participant from the third museum mentioned that she had been approached by a researcher interested in starting a partnership, and her experience in this project helped her see the value and benefit (see quotation).

I was especially struck by the mature relationships CDM has developed with both UC Berkeley and Santa Cruz. We have an opportunity here in Madison to foster similar collaborations with the University of Wisconsin—and although I was always positively inclined to do so, I didn't have many specific ideas of what that collaboration might be. Just today I was surprised by a call from a UW professor of psychology, who had been tapped as a consultant for a project at the Science Museum of Minnesota. He called wondering if we could talk about his desire to use Madison Children's Museum as a laboratory for research. Thanks to my experience at CDM . . . I enthusiastically accepted the offer to explore the possibilities. I would have been much more tentative, had not the Lupe workshop given me both concrete examples and also the confidence that such a partnership could work!

Almost all participants mentioned that they found CDM's exhibit development process and particularly their use of prototyping to be very useful to their practice. Participants viewed CDM's process as "rigorous" and commended their commitment to it (see quotation). Many participants saw value in this time-consuming but important process and became aware of the contributions of the evaluators, who helped define the intended impacts of the exhibits, and the research partner, who helped with the formative evaluation. Some participants noted that they are either already incorporating or are planning to incorporate some degree of prototyping into their exhibit development process.

Insight into the goals and implementation of CDM's prototyping process was extremely informative and inspirational. We continue to applaud both their rigorous dedication to refining exhibit experiences to achieve intended impacts. . . .

Almost all participants said learning about the evaluation process was very useful. Participants gained a lot from the workshop focused on creating impact statements and working with the group to define these statements. Participants also valued translating the impact statements into a rubric that defines success so the evaluator can measure the degree to which the intended impacts have been achieved (see first and second quotations below). Several participants said that they became aware of the value of

thinking about the evaluation and intended impacts during the planning phase of a project in addition to later phases (see second and third quotations below). Several participants also mentioned that they have developed or are planning to develop impact statements for projects at their own institutions. One participant mentioned that her team is already developing impact statements and working them into their grants; she believes that this practice has been instrumental in the multiple grants that her museum has recently received. Participants appreciated RK&A's willingness to share their tools and methods and several participants are either already using or planning to use the evaluation methods they learned, notably the observational tool, or integrating the rubric creation process into their own projects.

We have several projects where we can use rubrics to help us plan. The biggest project is our new museum. We are beginning to get into exhibit design and we realize that we will need to sit down and think about our goals, intended impacts, and what sort of evidence we'll be looking for that we've achieved those impacts once we open.

The rubric development was a helpful exercise to focus me into teasing out how I would evaluate whether a behavior was achieved. Also, this was the first time I had learned about impact statements as a powerful tool to state goals beyond demonstrating audience need. I was inspired to think differently about when we begin the evaluation process at the "seed" phase of exhibit and program development.

We especially benefitted from RK&A's cutting edge update of outcomes-based evaluation terminology and methodologies. The rubric development work reminded us of both the rigor and value of articulating intended impacts and supporting evidence to guide planning.

Almost all participants found it immensely helpful to network with other cohort participants and CDM project partners, share their experiences, and learn about new practices and perspectives. Participants highly valued the relationships they built and expressed that these relationships would continue into the future.

Many participants learned useful and innovative ways to approach science content, as in *Mammoth Discovery!* Such innovative ideas included the use of narrative and the local focus, taking into account children's experiences and applying those ideas to science experiences in their museums. A couple of the exhibits staff who attended the last workshop mentioned that they learned innovative approaches to exhibit design, particularly the effective use of technology in the exhibition.

Some participants saw value in having a variety of participants with varying viewpoints in the project, including the community of learners and other project partners. Some participants saw the benefit of receiving input from outside practitioners when planning an exhibition. One participant mentioned that as a result of her experience, she has invited consultants to work on a new project at her museum, and two other participants said that they are creating a community of learners local to their museum.

Some participants said that they learned a lot about the NSF grant writing process, which was very useful for potential NSF proposals. Several participants mentioned that these workshops were timely because their museums were in the process of significant structural changes. Therefore there is great potential for impact of this project. Lastly, a few participants mentioned that their participation in this project could improve their museum's credibility as a learning institution and generate more funding.

## SUGGESTIONS FOR WORKSHOP

When asked how the workshops could have been modified to be more useful, despite generally positive feedback, there were a few suggestions. Some participants appreciated CDM's responsiveness to the needs and questions of the cohort participants, who were consulted when creating workshop agendas. One participant mentioned that her questions from one workshop were addressed in the following workshop.

A few participants wished more time was spent on the exhibit development process, with a couple wanting to know more about how research informs exhibit development. A couple of participants mentioned wanting to learn even more about the literature on children's science reasoning and their understanding of evidence. These comments were shared after the first workshop; in response, the UCSC researcher presented her work in a more comprehensive context at the second workshop. One of these participants expressed at the end of the project how much she learned about children's science reasoning, but she still wished to know more. Other suggestions include the following: learning more about the goals for participation in the community of learners at the outset of the project; having a structured conversation after the paleontology field trip; and learning more about the NSF grant writing process. Lastly, a couple of cohort participants who attended only the third workshop wished that they had been involved from the start and felt that it would have benefited the project to have exhibits staff from each museum involved throughout.

## PERCEPTIONS OF DOING SCIENCE

When participants were asked in what ways the workshop affected their perceptions of doing science in children's museums most mentioned that the project's focus on fostering scientific process skills and reasoning was an innovative and worthy approach (see first quotation). For some, focusing on science process skills and reasoning was a new way to look at science learning and what science experiences in a museum can offer (see second quotation). A couple of participants left one of the workshops with the intent to use this approach to develop science experiences on their new science floor.

I applaud CDM's decision to take a more intelligent, process-oriented approach to the topic at hand than has been seen in many children's museum paleontology exhibits. The opportunity to incorporate actual prehistoric bones (authenticity!) and tell the story of the local discovery (personal connection!) would probably be enough to score a sure-fire hit with the legions of preschool paleontology experts. Instead, CDM chose to aim higher by expanding its academic partnerships to advance research about the development of scientific reasoning and take on the challenge of creating an exhibit that is transparent in its focus on thinking skills.

The workshop particularly sensitized me to the fact that the process of doing science is equally valuable to the content knowledge gained. Coming from a natural history background, I'm inclined to measure success by the knowledge visitors have gained on a particular topic. The workshop reassured me that having families participate in a process of inquiry was as important, if not more important, than the facts they retained at the end. This emphasis in helping kids learn how to think, rather than what to think, was significant in shifting my personal priorities.

Several participants mentioned that the project reinforced their belief that children's museums' approach to science content is most effective when it is presented holistically—in an interdisciplinary context and connected to children's experiences (see quotation). Some respondents appreciated the use of narrative and imaginative play as an approachable and creative way to present science.



It underscored the fact that we, as children's museums, are first and foremost serving the holistic needs of children rather than serving specific content areas or academic enrichment. The best approach to science in children's museums is to keep it interdisciplinary and connected to children's own experiences (including sense of place and local connections). The local connection to the CDM neighborhood was clearly a hook for visitors, and I hope the exhibit inspires more museums to develop locally-based stories and topics as they develop new exhibits.

Another respondent noted that adults and children might not see the "science" in what they are doing, which provides a challenge for museums, as they may need to consider explicitly labeling their experiences. Other perceptions included the following: a need to focus on children *and* adults doing science; the importance of adult-child interactions in learning; the benefits of having research partners in creating science experiences; and the perception that children's museums do not do science.

## HOW CHILDREN REASON WITH EVIDENCE

When participants were asked if anything surprised them about how children reason with evidence and/or how to develop exhibits that foster this behavior, many responded that there is still much to be determined from how children reason with evidence in the exhibition, and they look forward to hearing the results of the evaluation and research studies. Some participants acknowledged that developing exhibits that foster this type of understanding is difficult, and one questioned how to support children's learning in this manner without being overly directive (see quotation).

Our discussions during this workshop underscored that facilitating children's learning through the analysis of evidence is not an easy task. How do you facilitate critical thinking and exploration without leading children to an answer? How do you acknowledge and honor the existing body of knowledge upon which scientists build, without pre-loading an exploration experience with too much context or giving the impression that scientists already know it all? How do you make children aware that their natural behaviors of observing, asking questions, and experimenting are the things that scientists do every day?

A couple of participants were surprised to learn from this exhibition and a previous CDM exhibition how subtle changes in exhibit design can greatly influence visitor interactions in an exhibit. These participants saw the value of prototyping and applying research and evaluation to create intended experiences (see quotation).

But Maureen's initial research results that she presented at the meeting were very interesting. They definitely proved to me that exhibit design has an impact on the behavior of children in a science exhibit. Specifically, I'm thinking about the leg bone comparison exhibit. By altering the design of this piece, the team influenced more children to compare their legs to the mammoth's. They made a subtle change, but it had a great impact on the resulting behavior. This tells me that prototyping and exhibit evaluation is crucial to achieving the outcomes we desire.

Interviewees were excited to see the effect of telling a local story on children's experiences; seeing children "doing science;" seeing parent-child interactions build as they move through a space (as demonstrated in a video clip presented by the UCSC researcher); and noting how results from this project can inform research about evidence-based reasoning in other fields.



# PRINCIPAL FINDINGS: IN-DEPTH INTERVIEWS

## INTRODUCTION

RK&A conducted two sets of in-depth interviews with six staff from the three cohort museums to serve as phase one and two of the impact study examining the professional development component of the project. One set of interviews was conducted at the start of the project (phase one) and the other set was conducted toward the end of the project (phase two). Interviews were conducted by telephone, with the first set of interviews conducted between April and June 2009 and the second in December 2011.

## OVERALL EXPERIENCE

At the beginning of the project interviewees were asked what they hoped to gain from their involvement in this project; all interviewees mentioned that they were excited to work with CDM and the other cohort museums and to be part of this community of learners. Some interviewees said that they appreciated the opportunity to step outside of their own institution and were eager to learn from others. Some also mentioned that they respect CDM's previous work, and that all museums had much to gain from participating in this project (see quotation).

We all bring our perspectives and experiences, and we're all just enriched by that . . . we have a lot in common. We have regional differences, but we have much more in common than not. So we're all grappling with the same questions, same issues, and the same quandaries. So to be together talking about it, with our different perspectives, I just think that can be very enriching. I think we all have that to gain.

At the end of the project interviewees were asked to reflect on their overall experience, identify which experiences stood out, and what they gained from their involvement in the project. All interviewees were quite emphatic about how much they valued the sense of community and camaraderie that the group created (see quotations below). Some felt that the two most valuable aspects of the project were the community of learners and being part of CDM's exhibit development process. A few interviewees felt that their fellow participants were "kindred spirits" in the field and valued the new relationships that were formed. Several interviewees gained personally from their participation, saying that it was "inspiring," "mind opening," or "invigorating."

. . . to have the opportunity to have some sort of common cause with this group of just the highest quality. That's not the same as being in a session together . . . we're really sort of a layer of the [Lupe] project . . . I think obviously San Jose took the professional development aspect of the project very seriously.

Well of course the opportunity to be with my colleagues and our peer institutions. Actually you know working on something that we all work on at home you know in our own places with our own teams. But to be able to have the collective wisdom around the table thinking about the best way to uncover this subject to family audience and for children and to hear other people. So it just was that was really wonderful.

Most interviewees appreciated the diversity, experience, and quality of the professionals. Interviewees mentioned that the level of expertise of the group enabled very deep and rich discussions. A couple

mentioned that they felt that they were at the “cutting edge” of practice. Many contrasted this learning community experience with their typical conference experience when they interact with colleagues, noting that this project was more valuable because it allowed them to truly share a process and learn from others’ processes and expertise. Some appreciated being able to step out of their own daily grind and focus on another institution’s problems, which in turn helped them reflect on their own practices. Many interviewees valued having access to experts—referring to the other cohort staff, the CDM team, researchers, and evaluators. Several interviewees noted that they also felt invested in the exhibition. And finally, a couple appreciated that two staff members from each cohort museum were invited to participate in the project, giving them a shared experience and opportunity to deepen the affect of their experience on their home institution.

## EXPERIENCE WITH SCIENCE EXHIBITS

When asked what they hoped to gain from their involvement in this project, a couple of interviewees stated at the outset that they hoped to learn more about the development of science exhibits. These interviewees are from the same institution—one that is undergoing major changes including moving their museum into a new larger facility and building a new science floor. They hoped their involvement in the project would affect the development of the new science exhibits.

## PREVALENCE AND TYPE OF SCIENCE EXHIBITS

Interviewees were asked what types of science experiences they provide for children ages 5-10 years. All interviewees reported that their museums have science exhibits for children; however, the prevalence of science exhibits and how science exhibits were incorporated into their Museum varied by institution. Some interviewees mentioned they have science-focused exhibits, while others noted that science learning takes place when visitors engage in open-ended play. Others said their museums are interdisciplinary and include science, but they also mentioned a recent shift to develop an explicit articulation of science, as part of a grant-funded initiative that includes moving to a new building.

In terms of the types of current science exhibits, almost all<sup>6</sup> interviewees said their museums have physical science and engineering exhibits (e.g., water areas, building or designing exhibits, tinkerer’s workshop, phenomenon-based exhibits). A couple of the cohort museums have mathematics exhibits; one has a paleontology exhibit; one has a green roof with a focus on the natural sciences; and one has an exhibit about bones and the human skeleton. Almost all discussed that their educational programs have opportunities for science learning.

When asked to describe ways that their participation in *Mammoth Discovery!* affected the science experiences they create at their museum, some interviewees mentioned specific changes as a result of their participation. A couple of interviewees said that this project affected how they create science exhibits, with one mentioning that her involvement sparked a conversation at her institution about whether “science” should be more visible and explicit in the exhibits, and if so, how might they change them. Another interviewee said that she learned much about communicating the nature of science from the UCMP content researcher and her museum is already incorporating materials into their staff trainings and new exhibition.

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<sup>6</sup> One interviewee did not talk specifically about the types of science exhibits her museum has, however her colleague did. Thus, all of the cohort museums have science exhibits.

## CHANGE IN PRESENCE OF SCIENCE IN MUSEUMS' PRIORITIES OR MISSION

Interviewees were asked whether their museum had shifted the presence of “science” in their priorities, mission, or values over the last three years. Almost all mentioned that there has been a general move to include more science exhibits and/or make science more explicit. Interviewees tended to think that this shift was not due to their involvement in this project in particular; rather, it reflects a larger change in the field overall. A few interviewees expressed that the beginning of this project was serendipitous for them as their museums were just starting to change and a few mentioned that discussions held over the course of the project helped guide them.

Interviewees from one museum mentioned some degree of shift toward STEM but emphasized that their institution’s mission still focused on play. Interviewees from another institution also mentioned a shift toward STEM (one referred to it as STEAM—the “A” denotes art), just prior to the start of this project. One of these interviewees said that she and her staff chose to take the word “play” out of their mission statement in order to gain more credibility. Interviewees from the third museum mentioned already formed plans to incorporate more STEM content as part of their institution’s expansion. One interviewee said that this decision was due in part to the market research conducted with the residents in their community who seemed to be asking for more science. The interviewees from this museum mentioned that their participation in the project helped them think through how to best weave science learning into the museum’s interdisciplinary approach.

## LEARNING ABOUT PROTOTYPING

When asked what they hoped to gain from their involvement in this project, most interviewees said that they hoped to learn more about CDM’s exhibit development process and, in particular, its use of prototyping. This was later echoed by all interviewees in the second round of interviews when they were asked which experiences stood out to them from their involvement in this project. These interviewees expressed much respect for CDM’s commitment to prototyping and its thorough, rigorous approach to exhibit development. Several interviewees were impressed with CDM’s openness in sharing its process and saw the benefits that CDM gained from being open.

Several interviewees said that what allowed CDM to be truly committed to and successful with prototyping was the team’s humility and ability to focus on achieving the exhibition’s intended outcomes rather than an idea that was not working (see quotations).

...to see the staff’s real ability to be humble and say if, be able to look at something and say, ‘it’s not working, let’s start over,’ without being so attached to the thing that it winds up going out on the floor even if it doesn’t fully achieve those goals.

... to recognize that perfecting a process is as valid as the end result . . . you know *Mammoth Discovery!* is a very nice exhibit, but I think the process that CDM went through is even more impressive than the final physical result. And kind of a shame that visitors don’t see what all went into it. You know they’ll never appreciate the depth of care that went into this exhibit. And that part, that part’s a little regrettable that visitors won’t appreciate it, but this community of learners certainly does and the reputation of CDM for being thoughtful and comprehensive and conscientious and data driven, learning from evidence is not just learning from thoughts alone, it’s learning from the evidence of evaluation when things work and when they don’t work, and being willing to change your direction if you see you’re barking up the wrong tree.

When interviewees were asked which experiences prompted a new way of thinking or working, several mentioned that they incorporated some aspect of prototyping into their museum's process, though not to the extent that CDM has incorporated prototyping into its process.

## LEARNING ABOUT EVALUATION

At the beginning of the project when participants were asked what they hoped to gain from their involvement in the project, a couple of interviewees said that they hoped to learn more about the evaluation process and how it fits into different phases of exhibit development. Interestingly, at the end of the project when they were asked which experiences stood out to them, all mentioned CDM's use of evaluation and specifically the time spent on articulating impact statements. One interviewee was surprised by how much time was spent in workshops discussing evaluation and impacts and was especially surprised to see how valuable it was.

All interviewees valued the amount of time that the evaluators spent facilitating the development of these impact statements and the rubric that would be used to operationalize the impact statements, both for exhibit development and later for the summative evaluation to assess whether their intended impacts had been achieved (see first quotation below). Many interviewees mentioned that they appreciated having the opportunity to learn about evaluation more generally and that RK&A was willing to share evaluation tools. Some interviewees mentioned how the impact statements guided exhibit development and could be used in the prototyping process (see second quotation below).

That experience of creating those impact statements and, and then a rubric to go along with it . . . it felt empowering, I guess, that you're using evaluations to guide what you want to be doing in the first place. And that's not an extra thing, that's an essential thing.

. . . learning how their staff roles work together to achieve what they set out to do, while from the very get go identifying these impact statements. And the prototyping that goes along with that so that you're not just prototyping for things to work in a way that it doesn't break, but to work in a way that you're getting at that impact that you hope to achieve.

When interviewees were asked which experiences prompted a new way of thinking or working, many mentioned that what they learned about evaluation and impact statements enhanced their own practices. These interviewees said that creating impact statements not only helps in grant writing but when planning any museum project (see quotation).

Well I mean definitely working on the impacts, we tried to do that, not just when we're applying for a big grant, but in anytime that we're working on a project at the museum . . . really instill that this is the way you should go about your work instead of just diving into something and thinking about, oh what did we accomplish, afterwards, that it's a thoughtful way to go about your work and impact your community.

## LEARNING ABOUT MUSEUM-RESEARCH PARTNERSHIPS

When interviewees were asked which experiences stood out for them, all mentioned the opportunity of learning from both research partnerships involved in the project. Interviewees said that they appreciated learning about how to build and sustain partnerships as well as the value and expertise that partners bring to a project (see quotation).

. . . when starting this, I didn't quite recognize just how valuable of a partnership among the four sets of you really was and what kind of negotiations had to be done with that until I'd leave, and then have more of my own professional experience trying to cultivate those partnerships. And then going back and I came out with a, with a real appreciation for it and also I guess a hope that it is possible to cultivate such a thing and bring those lessons into my own work . . . I'm applying things that we have learned in these last few years to that, and I think that in the Museum in general, we're trying to look at partners in terms of what do we really want, why would we seek out a certain partner.

## **PARTNERSHIPS WITH LEARNING RESEARCHERS**

All interviewees valued learning about the partnership CDM has with learning researchers at UCSC and most viewed CDM's partnership as a model they are striving to achieve. Most interviewees also expressed much respect for the learning researcher, valuing her expertise, role in bridging research with exhibit development, and her willingness to assist cohort participants in their own work and current research partnerships (see quotations). One interviewee also mentioned that meeting this researcher was a personal goal and discussed having invited her to a statewide informal science educator's association conference in the interviewee's home state.

Just learning more about the collaboration between CDM and Maureen Callanan's lab, and hearing her research message, and their design process you know for integrating her research with their exhibit design.

[I'm] a long-time groupie follower of Maureen and Kevin Crowley . . . [I have] the highest respect for their work and was aware of course of CDM's long and such productive, fruitful relationship. But you know the first meeting was the first time that I had ever met Maureen . . . She's just so approachable. . . . This obviously is such a valuable partnership, but I just have to point out, I'm really realizing that there's something very serendipitous about Maureen's particular research interests and approach.

## **CREATING NEW RESEARCH PARTNERSHIPS**

Of the three cohort museums, only one had an ongoing relationship with a learning researcher prior to the start of this project. Yet, at the beginning, all interviewees stated their desire to either build or improve upon a partnership with a local learning researcher.

When asked what they hoped to gain from their involvement in this project all interviewees said that they hoped to learn more about building and sustaining an effective museum-learning research partnership. A few wished to build a relationship similar to the one that CDM has with UCSC. Several interviewees wished to find out how to strengthen their existing relationship or initiate a new relationship so it is mutually beneficial to both partners—the museum and researcher. A couple of interviewees wanted to learn how to establish such a relationship.

When asked in their second interviews whether they have considered a partnership with a local learning researcher, all interviewees mentioned having a current or an upcoming partnership. Interviewees from one institution that already had such a relationship before the start of this project were working on improving their existing relationship. Interviewees from another institution mentioned that their museum's involvement in such a partnership was just beginning through their participation in a nationwide program called Living Laboratory led by the Museum of Science in Boston. Living Laboratory aims to build museum-learning researcher partnerships in a number of cities across the country. One of these interviewees said that her decision to become involved in the latter program was

greatly influenced by her participation in *Mammoth Discovery!* (see quotation). The third institution began a partnership with a local learning researcher—someone recommended by the UCSC learning researcher.

CDM's experience in working with researchers, which happened at the same time we were learning about Museum of Science's program with Living Labs, all came together in a very serendipitous way whereby . . . Museum of Science was looking to expand its Living Labs program. And we volunteered and or were recruited to be one of their dissemination sites. . . . I don't think that we would have been as mentally receptive or prepared for this collaboration with the Museum of Science in Boston if we had not been part of the *Mammoth Discovery!* experience, because that experience prepared us to, or made us aware of the benefit that such a collaboration could have.

The benefits of a museum/learning research partnership were also discussed; most interviewees said that this type of partnership adds credibility to their institutions and provides opportunities. Further, these interviewees mentioned their interest in targeting adults and helping adults learn about their children's thinking while in their museum by having the learning research more accessible and visible to visitors (see quotations). Others mentioned that such research could inform museum exhibit development.

That it would directly create funding to support this. It might offer us research opportunities that would be resources in terms of exhibits or evaluation or just being part of research studies . . . being on the leading edge of the field and being able to make contributions as well as understanding our practice better. But also having the public being aware of all that. I think this, yes. Credibility you know, status that the museum is a resource to the community. . . . And we're really struggling to come out of a perception of being just the place for little kids . . . a nice place to go on Saturday afternoon which is why we struck play from any of our mission statement.

. . . the benefits to us is, us the Museum, is deepening our connection with the university, expanding our mission to be more than just a great place to play. We really are advancing the understanding of how kids learn. We can apply those lessons to our exhibits so that our exhibits are even more effective. And our parents are able or are made more aware of the fact that play is kid's work, that it is important for their kid to play because that is the natural way to learn, and this is what they're learning when they do these particular play behaviors. So it helps us justify our existence and take the museum experience from just nice to necessary . . . that your kids have to play in order to learn. And when they do these different behaviors this is what they're learning and you can advance that home by providing similar opportunities.

. . . what we are committed to doing is we want to make visible that research is being done even if it is not necessarily in conjunction with our exhibit. So through this process we learned that what we could do is, is take what's happening already but brand it, get it out there, explain to visitors what we're doing and that this research is being done here at the Children's Museum. So we now call the research that's being done Mind Lab . . . we're being more open with our visitors that this is happening.

When interviewees were asked about the challenges they have experienced in establishing these partnerships most said that it is difficult to create a mutually beneficial partnership. These interviewees said that these partnerships were not collaborative and that they struggled with how to create mutual goals (see quotations). Interviewees wished that the researchers' questions were more relevant to the museum so that they could be integrated into exhibit development. Several interviewees explained that the researchers' methodologies are experimental in nature and involve inviting visitors to participate in



their research and then bringing them to a separate room in the museum. Some of these interviewees mentioned that they wished that their research methodologies could be more observational and take place in the museum exhibits, which might support the museums' needs. A couple of interviewees said that they found it difficult to find space in their museums for researchers to work. A couple of interviewees mentioned having some communication challenges with their researcher since s/he works in a very different institution. Lastly, one interviewee said that it was a hard to find a good research match.

I think that it's real key to having outcomes that everybody's happy with . . . that both partners have similar goals. And I think that Christine is really interested in this experimental method and what that shows. And it's really interesting for us and I think that we can theoretically apply it to our work. But until it goes to this next step of actually observing them interact with exhibits, I don't think that we can say that it's directly practically impacted our exhibit development. . . . I think it has to do a lot with the method and Maureen's methods are observational and the data that she's gathering is in the actual exhibits. It can tell you a lot about the way people are gonna use and understand your content.

Oh the having defining a mutual goal you know. Researchers they have their labs and their experiments and that's what they're doing and they're of necessity focused narrowly. They have to be. You know they're not saying all children learn best by playing, that's a big huge general statement that they're not their research isn't all designed to, answer. But that's how we have to do. We have to be broad we're, we're practitioners and we're generalists where they're researchers and experts. So what do they need to find out that we need to find out too, you know, that would be mutually beneficially. Not much. See what I mean. So unless you know we work out something like with the kind of thing that Maureen does, like what are people actually doing in this exhibit. But that's our research not theirs.

When asked how their museum has attempted to address these challenges several interviewees discussed their excitement for a potential cross-site project led by the learning researcher from UCSC which would involve CDM and two of the cohort museums and their research partners. These interviewees said that they valued the two-way relationship CDM and the UCSC researcher developed and believed that this project could help align the goals between the partners at the other sites. A couple of interviewees said that in order to address challenges, they have invited their researchers and their graduate students to present their work to the museum staff. Finally, one interviewee mentioned that their museum has spent time reflecting on its relationship with its research partner and realized that the constraints, needs, and goals of researchers are by nature different from the museum's goals.

## **PARTNERSHIPS WITH CONTENT RESEARCHERS**

At the beginning of the project when participants were asked what they hoped to gain from their involvement in the project, most mentioned that they hoped to learn more about CDM's partnership with content researchers at Berkeley. Later when asked to reflect on the research partnerships involved in *Mammoth Discovery!* some interviewees discussed how much they valued the content researchers from Berkeley. A couple of interviewees appreciated the expertise of these researchers when the group went on their paleontology walk at a local beach. Another interviewee valued getting to know the content researcher and her work, which she is already incorporating into her practice at her museum.

## GAINING KNOWLEDGE ABOUT CHILDREN'S EVIDENCE-BASED REASONING

When interviewees were asked what they hoped to gain from their involvement in this project, most interviewees mentioned that they were eager to learn about the development of exhibits that incorporated children's use of evidence. A couple specifically mentioned that they appreciated this new and clever approach to the topic, focusing on science processes rather than just content (see quotation).

I was really interested to learn about how children use evidence and how to create an exhibit that's about process and not just . . . about the mammoth. It's about investigating the mammoth.

After the last workshop when interviewees were asked to reflect on their participation, responses suggest that most interviewees found this aspect of the project and the questions that emerge from it to be very interesting and valuable. Several mentioned that they could not say more about it since they are still waiting on the data from the research and evaluation studies. One interviewee mentioned that this part of the project was the most difficult, while another thought that while difficult, it raised a lot of fascinating questions (see quotation).

Yeah, I'm really curious to know how that works out. . . . I think it's a fascinating question because you know on some mysterious collection of evidence children also come to some pretty crazy conclusions . . . we've often quoted the kid on the plane looking out the window and asking his parents when are we going to get small, based on the evidence that planes get smaller and smaller [in the sky]. So aren't we gonna get small, I mean, that's evidence right ... it shows that children use evidence. And we love those stories. But we also know that very often they come to conclusions that are just so delightfully naïve. But it's still like marvelous that they use evidence but, how do you help them use evidence to come to the conclusion you know a paleontologist would come to. See what I mean. I think that's, that's really interesting. So I don't know. I don't know the answer to that. I love the question.

Interviewees were then asked in what ways their museum has integrated evidence-based experiences into their programs and exhibits. A couple of interviewees mentioned that such experiences have been incorporated in some way into their science programs but not explicitly into their exhibits.



# PRINCIPAL FINDINGS: COHORT WORKSHOP OBSERVATIONS

## INTRODUCTION

An RK&A evaluator observed the third workshop held at CDM in December 2011 to gain context for this professional development program, the community of learners as a group, and to better contextualize the reflections of the cohort participants' experiences in this program.

## ATTENDEES

In addition to the core cohort participants and the additional staff from the cohort museums, other attendees to the third workshop represented the Children's Discovery Museum, University of California, Santa Cruz, University of California, University of California, Berkeley, Museum of Paleontology, and Randi Korn & Associates, Inc. These attendees included:

### *CHILDREN'S DISCOVERY MUSEUM OF SAN JOSE*

- ◆ Jenni Martin, Director of Education;
- ◆ Sara De Angelis, Manager of Exhibit Design;
- ◆ Steve Tornallyay, Director of Exhibits and Facilities;
- ◆ Margaret Middleton, Exhibit Designer;
- ◆ Sandy Derby, Environmental Education Manager/BioS.I.T.E. Program;
- ◆ Karen Peck, Outreach Coordinator;

### *UNIVERSITY OF CALIFORNIA, SANTA CRUZ (UCSC)*

- ◆ Maureen Callanan, Professor of Psychology;

### *UNIVERSITY OF CALIFORNIA, BERKELEY, MUSEUM OF PALEONTOLOGY (UCMP)*

- ◆ Judy Scotchmoor, Assistant Director of Education and Public Programs;
- ◆ Kaitlin Maguire, Doctoral Student

### *RANDI KORN & ASSOCIATES, INC. (RK&A)*

- ◆ Debbie Siegel, Evaluator

## WORKSHOP AGENDA

The third workshop was held at CDM in San Jose on December 5 and 6, 2011. During day one cohort participants viewed the completed exhibition and shared their general impressions. The evaluator from RK&A reviewed the impact statements and provided further explanation concerning how these impact statements were translated into data collection tools for the summative evaluation. Cohort participants were then able to reflect on how well the exhibition met these intended impacts. Prof. Maureen Callanan presented some preliminary findings from her research on children's learning in the exhibition. CDM staff conducted presentations and demonstrations were also conducted on educational programs as well as other initiatives being created at the museum and throughout San Jose that relate to the exhibition. On day two, cohort participants were given time to reflect on their experience as well as brainstorm about future steps for their institution, this group and the field as a whole.

## REFLECTIONS

This section describes the general themes based on observations that emerged during the workshop.

### **REACTIONS TO EXHIBITION**

Cohort participants had a very positive reaction to the exhibition. Among aspects participants commented on were the sophisticated aesthetics of the exhibition, the simple and clever use of signage, the innovative approach to content, the integration of technology, the focus on science process skills, the use of narrative in the exhibition, the repetition of main messages, and the location of the exhibition within the museum. Since most participants were part of conversations held early on in the exhibition development process, many were interested to see how various challenges were overcome in the final exhibition and were pleased with the outcome. Participants also reflected on how well the exhibits met the intended impacts of the exhibition. They noted areas of success and provided constructive feedback concerning potential areas of confusion for children as well as aspects of exhibits that could meet the intended impacts more effectively. (See Appendix D for comprehensive list of participants' comments).

### **EXPERTISE**

Workshop attendees were a select group of experts coming from the fields of Museum Education, Psychology, Paleontology, and Evaluation. The number of years in their respective fields ranged from 3 to 43 years and averaged 18 years; combined, attendees' overall experience totaled 334 years. Observations revealed that conversations were deep and rich throughout the two days. Participants commented on how excited they were to have been part of this group of experts and learn from others. Junior staff in museum education mentioned that the experienced members of their field became their mentors but also felt that the group was open to their ideas. Museum staff in general appreciated learning from and having continued contact with a learning researcher and evaluators; the experience helped them plan their exhibits more strategically and evaluate more holistically.

### **SENSE OF COMMUNITY**

Conversation among the group revealed a real camaraderie and sense of community had been developed. Much discussion focused on the investment each participant had in the project, the inspiration afforded by the project and its people, how well they worked together, and their desire to keep this community of learners intact in some capacity so relationships and conversations can continue to flourish. Core cohort members as well as those who were attending this group for the first time were asked repeatedly to talk about what made this group work and how one might create this type of community and camaraderie in other groups. They appreciated being part of a group of like-minded professionals and the opportunity to be honest, open, and share ideas. One participant remarked and others agreed that meeting in this forum was more beneficial than meeting colleagues at national conferences. In addition, several participants mentioned that they valued the sense of community and connectedness that grew from their interactions since they typically feel quite isolated in the field.

Participants also expressed much respect for CDM and its staff. Specific aspects they commented on included CDM's dedication to and rigorous practices in exhibit development, staff members' openness and humility in sharing their process, and their openness to others' reactions and input.

The learning and content researchers also valued the cohesiveness of this group and the new relationships that resulted from it. The learning researcher from UCSC noted that this group was unique and different from the typical advisory group for museum projects. The content researcher from UCMP referred to future contact with the learning researcher and how they and their institutions can continue to learn from each other.

### ***NEW KNOWLEDGE AND EFFECT ON PRACTICE***

Upon reflecting on learning about other museums' practices, participants noted that they gained new knowledge and were already incorporating their new knowledge into their practice at their own institutions. New practices included using impact statements to guide exhibit development, prototyping during exhibit development, and using information about the nature of science and science understanding to guide programs and prototyping.

The depth of conversation revealed a sophisticated understanding of museum practices, evaluation, and research. When cohort participants were asked to use the evaluation tools in the exhibition and reflect on whether the exhibition met its intended impacts, they were quite adept in using the tools, understood that they were collecting evidence of learning in the exhibition, and were able to base their judgments about the impacts on the evidence collected. Further, when the learning researcher raised questions concerning how best to examine children's learning about and use of evidence in the exhibition, the cohort participants provided relevant and very helpful suggestions, revealing their understanding of the research component of this project. They also referred to other research studies that had been mentioned at previous workshops.

### ***RESEARCH PARTNERSHIPS***

All participants discussed current or future partnerships with other institutions and viewed CDM's partnership with learning researchers as a model they strove to achieve. Several of the cohort participants were excited about a potential museum-research collaborative project that would be led by the learning researcher. The learning researcher, a colleague of the researchers in Austin and Providence who are partnering with two of the cohort museums, discussed plans to submit a grant that would be a collaborative museum-research project across three of the museums.

## APPENDIX A: REFLECTION PAPER PROMPTS

### Instructions

As part of the NSF grant, the CDM is asking each cohort museum staff to write three reflection papers—one after each workshop. These papers will be analyzed by Randi Korn & Associates, Inc. (RK&A), to examine the impact of the project’s professional development component. After examining the written responses, RK&A will prepare a final report for NSF. Your responses will be confidential and anonymous.

RK&A has posed a few open-ended questions to guide your reflection. The questions are intended to foster thoughtful responses of a paragraph or two—not a short answer and not a lengthy essay. Please complete your reflection papers within two weeks of attending the workshop. Please type in your responses within this word document and e-mail your papers to [siegel@randikorn.com](mailto:siegel@randikorn.com).

### Questions

1. Since attending the workshop a few weeks ago, what thoughts, if any, have you had about it?
2. What aspects of the workshop did you find most useful to your professional practice?
3. How might the workshop have been modified to be more useful to you?
4. What, if any, tools, strategies, ideas, content knowledge, inspirations, etc., did you take away from the workshop?
5. How will you apply those tools, strategies, ideas, knowledge, inspirations, etc., at your museum?
6. In what ways, if any, did the workshop affect your perceptions of doing science in children’s museums?
7. What, if anything, surprised you about how children reason with evidence and/or how to develop exhibits that foster this behavior?
8. For the final question, please think about the *Mammoth Discovery!* project as a whole. In what ways, if any, do you think your participation in this project will impact your museum?

## APPENDIX B: COMMUNITY OF LEARNERS INTERVIEW GUIDE – INTERVIEW #1

[Request permission to audio-record] I would like to audio-record this interview to have an accurate record of our conversation. Your responses are confidential. [Once agreement is reached, turn on audio-recorder.]

To give you some background information, my firm, Randi Korn & Associates, was asked by the Children’s Discovery Museum in San Jose to conduct interviews with staff from children’s museum across the country to understand whether and how they are creating science experiences in their institutions. These interviews also will inform a standardized questionnaire that we will launch during the Association of Children’s Museum Annual Conference in April.

1. For my background information, can you talk a little bit about your museum—what audiences do you serve, what is the institutional mission, etc.?
2. Your title is \_\_\_\_\_. Since every institution is a bit different, how would you describe your responsibilities at your museum? How long have you worked in this museum?
3. What would you say are the strengths of your museum and your fellow staff?

As you may know, the Children’s Discovery Museum is developing a new exhibit about the mammoth nick-named Lupe that was discovered in San Jose a few years ago. The target audiences for the project are children ages 5 to 10 and their parents/caregivers. One unique aspect of this project is that the CDM is collaborating with the UC Berkeley Museum of Vertebrate Paleontology for paleontology expertise and the UC Santa Cruz Department of Psychology for research on how children develop scientific thinking skills.

4. In general, what barriers or problems do you think children’s museum staff face in developing science-related experiences for children ages 5 to 10? [Probe: “What do you think children’s museums need in order to do science?”]
5. At your museum, what institutional expertise, competencies, and motivations exist that might foster the development of science-related experiences for children ages 5 to 10?
6. In what ways, if any, do your museum’s priorities, mission, and values support developing science-related experiences for children ages 5 to 10?
7. What might your museum gain from developing a partnership with one of your local universities? What challenges might you face in developing such a partnership?
8. My final questions are about being a cohort museum for this project. What do you hope to gain from your experiences with *Lupe’s Story*<sup>7</sup>?
9. What do you think CDM can gain by working with you and the other cohort museums?

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<sup>7</sup> *Lupe’s Story* was the original title for this exhibition. It was later changed to *Mammoth Discovery!* before the exhibition opened to the public.

Those are all my questions. Thank you so much for taking the time to talk with me. Your comments along with your colleagues will be analyzed, a report will be prepared, and the findings will be distributed to study participants in the summer. Thanks again for your input.

## APPENDIX C: COMMUNITY OF LEARNERS INTERVIEW GUIDE – INTERVIEW #2

As you know, Randi Korn & Associates is the project evaluator for *Mammoth Discovery!* in San Jose. With the third cohort workshop now complete, as part of the evaluation we are talking with cohort participants to understand the impact of the experience on them personally and their museum. I have a few questions that I would like to ask you, and I would also like to audio-record this interview to have an accurate record of our conversation. Your responses are confidential. [Once agreement is reached, turn on audio-recorder.]

1. For context, can you talk a little bit about your museum—what audiences do you serve, what is the institutional mission, etc.?
2. Your title is \_\_\_\_\_. Since every institution is a bit different, how would you describe your responsibilities at your museum? How long have you worked in this museum?
3. CDM developed *Mammoth Discovery!* as part of an NSF award. You attended three cohort workshops at CDM and several meetings at ACM. Based on your participation in this project, which experiences stand out to you?

Which experiences, if any, prompted a new way of thinking? Which experiences, if any, prompted a new way of working? What are you doing differently?

4. Can you describe the science-related experiences for children ages 5 to 10 currently available in your museum? In what ways, if any, has your participation in *Mammoth Discovery!* affected the experiences you created and how you created them?
5. In what ways, if any, has your museum shifted the presence of “science” in its priorities, mission, and values in the last three years? What is your museum doing differently as a result?
6. One part of this project focused on CDM conducting research with children through a partnership with a local university. In what ways, if any, has your museum either done or considered this?

[If the museum has done or considered it]:

- a) Can you talk about that a little bit more?
- b) What do you see are the benefits of this type of partnership?
- c) What have been some of the challenges?
- d) How has your museum addressed these challenges?

[If the museum has not done or considered this]:

- a) Are there plans for your museum to develop this type of partnership?
- b) Why or why not?

7. *Mammoth Discovery!* is designed to include evidence-based experiences for children. This is a very new idea in all museums—not just children’s museums. Can you talk about the meaning that part of the project had for you?
8. Over the course of your participation in this project, in what ways, if at all, has your museum integrated evidenced-based experiences into its programs and exhibits?

9. What has your involvement with this project demonstrated to you, personally? (Probe):
  - a. What did you gain from your experiences with *Mammoth Discovery*?
10. What do you think your museum has gained?
11. What do you think CDM has gained by working with you and the other cohort museums?
12. Those are all my questions, but if there is anything else you would like to add, please do.

Thank you so much for taking the time to talk with me. Your comments—along with your colleagues—will be analyzed; a report will be prepared for CDM and NSF. Thank you again for your input.



## **APPENDIX D: COHORT PARTICIPANTS' COMMENTS ABOUT *MAMMOTH DISCOVERY! EXHIBITION***

### **GENERAL IMPRESSIONS AFTER SEEING FINAL EXHIBITION**

- ◆ Very elegant – aesthetic of its own – looks different from the rest of the museum – clean and calming. Does not have a typical noisy science museum aspect – a quietness that is nice.
- ◆ Not a crazy, run around, climb on everything place. Not playful – more sophisticated.
- ◆ Interactives are good to play with, but not typical craziness
- ◆ A lot of science, but simple and in a variety of formats – simplicity of signage appreciated. Could get information in multiple ways including video.
- ◆ Some of the challenges were overcome by simple solutions
- ◆ So many unexpected ways of learning about things – shadow brackets, holograms, video – really innovative
- ◆ Well executed- but I was looking at the technical details – everything looks beautiful. I need another crack at it.
- ◆ Use of integration of technology was very good – so many times you feel overwhelmed, but this was really integrated. The technology was in service of the ideas
- ◆ You called attention to biases that others might not be aware of like the gender bias.
- ◆ You aimed high for the process skills and not just content – the process of discovery and causal reasoning – beautiful job – elegantly simple without being didactic
- ◆ It really is amazing!!
- ◆ I enjoyed approaching the experiences like a visitor – I really enjoyed the experiences myself of being a scientist. Liked the variety of approaches from the play area for toddlers to more sophisticated
- ◆ Color palette was really nice and very engaging – muted and earthy – fitting to paleontology and about the earth.
- ◆ Like the way that exhibit started – Roger walking his dog. And the technique – first person narrative – a person in the community – very powerful - and even more background that could be found with the touch screens
- ◆ You return several times in different ways to change over time from the hologram to the spin browser (loved spin browser)
- ◆ Kept coming back to we found this piece and from this piece this is what we learned. Kept reinforcing the pieces of the puzzle evidence strategy.
- ◆ Great to highlight Kaitlin.
- ◆ Situation of the gallery – awesome – love the outdoors makes it even more powerful. A well-chosen site. Could see the river.
- ◆ You made the space bigger by the way that you divided it. Very efficient use of the space.
- ◆ Stories about how the bones were found- exciting.
- ◆ Diorama is where the younger kids will automatically hang out – imaginative play.
- ◆ One mom tried to “narrate” but probably over the kid’s head.
- ◆ Two moms on a play date – people come to us for many reasons. So they were not collaborative, but still selected to come here and who knows what they are talking about.

## REFLECTIONS ON EXHIBITS MEETING INTENDED IMPACTS

### ***AS A RESULT OF VISITING THE MAMMOTH DISCOVERY! EXHIBIT, CHILDREN WILL ENGAGE IN SCIENTIFIC THINKING (I.E., SCIENCE AS A CREATIVE PROCESS)***

- ◆ A lot of places where questions could be explored together and a lot of places to come up with your own questions. In some cases the questions were put out and wondered – does the visitor know what they are being asked. E.g. look for patterns when looking through the microscope
- ◆ Needed better explanation: thigh bone chair – not obvious what you are doing. Too subtle. Otherwise everything else it is apparent what you are supposed to be doing.
- ◆ A lot of activities supported process – some very clear, some more open-ended – the latter probably will spark more question. Beautifully done. Good to see mix. Some confusions about femur. The biggest wow was the shadows of the femur on the wall, but wanted to know how it worked. Look forward to seeing how kids use it.

### ***AS A RESULT OF VISITING THE MAMMOTH DISCOVERY! EXHIBIT, CHILDREN WILL BECOME AWARE THAT THEY CAN AND ARE ENGAGING IN A PROCESS SIMILAR TO THAT IN WHICH SCIENTISTS ENGAGE.***

- ◆ Difficult to judge within observation without children. Purely observational, but some do it really really well – especially the simplest ones. Didn't look up when they were doing the shadows so had not seen the animal! Videos of science professionals which was helpful, but too passive. Will kids really listen to them? They DO really reinforce the messages. E.g. you are building a puzzle. Scientists do this all the time! Maybe embed this within exhibits too. I want to observe kids to determine what they really are getting. Pushes against explanatory text. But hesitant to judge without seeing kids within exhibition. Strongest parts are the simplest.
- ◆ For the rollerskate – may make connection to scientists but may not – won't know without talking to kids. Would kids do the activity you want them to do or something else?
- ◆ I can only guess what kids might do, so would prefer to see kids and then respond. Some things – e.g. do kids make the connection between the light table and the big mammoth. Do they look up and down and make the connections. [Comment: Sometimes the connections do not happen at that moment, but sometimes it clicks later on.] Caregiver may have role in drawing connections. Some exhibits designed for collaboration. Beautiful artwork. [OK to have experiences within proximity even if the direct connection is not made] Provide experiences to later reflect and remember. What scientists do repeated throughout

### ***AS A RESULT OF VISITING THE MAMMOTH DISCOVERY! EXHIBIT, CHILDREN AND THEIR CAREGIVERS WILL LEARN ABOUT MAMMOTHS THROUGH EVIDENCE.***

- ◆ Multiple layering of content. Always more than one place where the content was presented. E.g. change over time the animation, graphic, create a story, etc. A little confusion might occur with the comparison of teeth. What is the purpose of the mirror? (How it was angled) Did not drive inquiry as much as it could have. What if they explore and they still don't know the answer? Is that OK? Appreciates difference in writing especially questions.
- ◆ Use of word evidence used throughout. All big idea messages are repeated that is really helpful. "Scientists have learned that..." And several messages about San Jose changes. Area next to teeth where the replica is – the sign says something about the pelvis and not connected well to the metal pelvis. Placement is confusing. Repeated timelines of mammoth and people.

***AS THEY VISIT THE MAMMOTH DISCOVERY! EXHIBIT, CAREGIVERS WILL SUPPORT CHILDREN'S LEARNING THROUGH COLLABORATIVE EXPLORATION.***

- ♦ Physical environments support multiple users and interaction– e.g. several benches instead of stools. Does not require cooperation but invites collaboration and that is a good thing. Made a choice not to be didactic in exhibits. Don't tell explicitly. More demonstrative about process. With a focus on process we were not sure what we were supposed to see. E.g. see a layer with lots of fossils, then what? Were we supposed to see grains in the poop? Poop exhibit could be richer.
- ♦ A lot of building challenges – a bunch of semi - familiar information, which puts the adult in the role of teacher instead of collaborator. But what was really good, was that some really demanded collaboration – e.g. puzzle pieces (pelvis), becoming a fossil invites multiple people (spin browser), make a story (story telling cards)- very open-ended. And some push towards didactic. Very few simple statements told again and again in multiple ways. Layering of information helps adults learn content – helping them move from just teacher to collaborator.